ERCB REPORT 74-E

REVIEW OF THE ALBERTA COAL INDUSTRY 1973

MARCH 1974

ENERGY RESOURCES CONSERVATION BOARD

603 SIXTH AVENUE S.W. • CALGARY, ALBERTA, CANADA • T2P 0T4

104-03957/

REVIEW OF THE ALBERTA COAL INDUSTRY 1973

MARCH 1974

ENERGY RESOURCES CONSERVATION BOARD

603 SIXTH AVENUE S.W. • CALGARY, ALBERTA, CANADA • T2P 0T4

Price: $10.00

TABLE OF CONTENTS

Section		Page
	PREFACE	i
	SUMMARY	ii
1	INTRODUCTION.....	1-1
	1.1 Views of the Participants	1-1
	1.2 Board Staff Discussions and Visits	1-12
	1.3 Cost Data and Production Figures	1-12
2	HISTORICAL REVIEW.....	2-1
3	DISTRIBUTION AND RESERVES OF COAL.....	3-1
	3.1 Distribution	3-1
	3.2 Reserves	3-2
4	THE STRUCTURE OF THE ALBERTA COAL INDUSTRY.....	4-1
	4.1 Ownership and Disposition of Coal Rights	4-1
	4.2 Principal Coal Companies	4-6
	4.3 Industry Organization	4-13
	4.4 Regulation of the Coal Industry	4-16
5	CURRENT PRODUCTION, DISPOSITION AND VALUE, PRICING AND REVENUE.....	5-1
	5.1 Production	5-1
	5.2 Disposition and Value	5-2
	5.3 Pricing	5-4
6	TRENDS AND TECHNICAL DEVELOPMENTS BEARING ON DEMAND, SUPPLY AND PRICING.....	6-1
	6.1 Factors Determining Coal Demand	6-1
	6.2 Factors Determining Coal Supply	6-12
	6.3 Pricing Trends	6-17

Section		Page
7	MARKETS AND MARKET PROSPECTS.....	7-1
	7.1 The Coal Market in Alberta	7-1
	7.2 Coal Markets in Ontario	7-3
	7.3 Coal Markets in Saskatchewan	7-5
	7.4 Markets in Japan	7-6
	7.5 Markets in the United States	7-9
	7.6 Markets in South America	7-10
	7.7 Markets in Western Europe	7-11
	7.8 Total Markets and Forecast Production	7-12
8	CURRENT AND PROJECTED ACTIVITIES, EXPENDITURES AND EMPLOYMENT.....	8-1
	8.1 Exploration	8-1
	8.2 Mining	8-2
	8.3 Processing	8-9
	8.4 Transportation	8-10
	8.5 Marketing	8-12
	8.6 Summary	8-13
9	IMPACT ON INDIVIDUAL COMMUNITIES.....	9-1
	9.1 Introduction	9-1
	9.2 Impact on Communities in the Mountain Region	9-2
	9.3 Impact on Communities in the Plains Region	9-15
	9.4 Projected Developments	9-19
	9.5 Typical Community Impact by the Annual Production of One Million Tons	9-21
10	ENVIRONMENTAL ASPECTS.....	10-1
	10.1 Effects on Air Quality	10-1
	10.2 Effects on Water Quality	10-2
	10.3 Effects on the Land Surface	10-2

Section		Page
11	IMPACT ON THE ECONOMY OF ALBERTA.....	11-1
	11.1 Expenditures on Goods and Services	11-1
	11.2 Employment	11-2
	11.3 Alberta Government Revenues and Expenditures Related to the Alberta Coal Industry	11-3
12	OBSERVATIONS AND RECOMMENDATIONS.....	12-1
	APPENDIX A.....	A-1
	Order in Council numbered O.C. 289/73	
	APPENDIX B.....	B-1
	Informational Letter No. IL-C 73-3 Coal Industry Study	
	APPENDIX C.....	C-1
	Housing Policy for McIntyre Employees	

LIST OF TABLES

Table		Page
1-1	Participants	1-2
3-1	Classification of Coal	3-4
3-2	Proved Remaining Reserves of Coal in Alberta (At December 31, 1972)	3-5
4-1	Distribution of Coal Rights on Lands Underlain by Proved Recoverable Reserves	4-2
4-2	Distribution of Coal Rights on Lands Underlain by Coal-Bearing Strata	4-2
4-3	Major Companies with Coal Rights Acreages in Alberta	4-9
4-4	Other Companies with Coal Interests in Alberta	4-14
4-5	Coal Association of Canada Membership	4-15
5-1	Importers and Consumers of Alberta Metallurgical Coal	5-5
5-2	Thermal Coal for Generation of Electric Energy in Alberta	5-6
5-3	1973 Prices for Sized Domestic Coal	5-8
5-4	Price Movements of Prepared Alberta Metallurgical Coal	5-10
7-1	Projected Japanese Demand/Supply for Coking Coal	7-8
8-1	Major Coal Mining Operations in Alberta	8-5
8-2	Employment - Mountain Region Mining (1973)	8-6
8-3	Employment - Major Plains Region Mining	8-6

Table		Page
9-1	Town of Hinton.....	9-6
9-2	Estimated Breakdown of Living Accommodation Cardinal River Employees.....	9-7
9-3	Town of Canmore.....	9-10
9-4	Employment Distribution Coleman Collieries July 1973.....	9-12
9-5	Crowsnest Pass Area.....	9-14
9-6	Towns of Forestburg and Halkirk.....	9-17
9-7	Typical Impact of Alternate Coal Mining Ventures - 1972.....	9-22
11-1	Income Disposition - Alberta Mining Industry.....	11-4
11-2	Alberta Government Revenues and Expenditures Related to the Alberta Coal Industry.....	11-6

LIST OF FIGURES

Figure		Page
2-1	Employment and Productivity in Alberta Coal Mines 1906-1950.....	2-2
2-2	Annual Production of Raw Coal in Alberta 1906-1950.....	2-3
2-3	Annual Disposition of Marketable Alberta Coal 1906-1950.....	2-4
2-4	Annual Value of Marketable Coal in Alberta 1906-1950.....	2-5
2-5	Annual Number of Coal Mines Opened and Abandoned in Alberta 1906-1950.....	2-7
2-6	Employment and Productivity in Alberta Coal Mines 1951-1973.....	2-9
2-7	Annual Production of Raw Coal in Alberta 1951-1973.....	2-10
2-8	Annual Disposition of Marketable Alberta Coal 1951-1973.....	2-11
2-9	Annual Value of Marketable Coal in Alberta 1951-1973.....	2-12
2-10	Annual Public Expenditures on Coal Research and Development in Alberta 1945-1973.....	2-13
3-1	Major Coal Bearing Formations and Gross Calorific Values of Coal.....	3-3
3-2	Coal Regions, Coal Fields, Isolated Coal Deposits, Producing Coal Mines & Coal-Fired Power Plants.....	3-6
4-1	Major Coal Rights Holders.....	4-3
5-1	Annual Coal Consumption for Electric Energy Generation in Alberta 1962-1973.	5-3
6-1	Coal Gasification.....	6-11
6-2	Projected Annual Coal Price for Electric Energy Generation in Alberta.....	6-19

Figure		Page
7-1	Projected Annual Coal Demand for Electric Energy Generation in Alberta..	7-2
7-2	Forecast of Thermal Coal Production in Alberta.....	7-13
7-3	Forecast of Processed Metallurgical Coal Production in Alberta.....	7-14
8-1	Major Exploration Projects.....	8-3
8-2	Annual Alberta Production of Thermal Coal for Electric Energy Generation 1962-1973.....	8-8

PREFACE

This report is the response of the Energy Resources Conservation Board to a request by the Government of Alberta that the Board inquire into and report on the current and future impact of the Alberta coal industry on the economy of the Province and advise on certain specific matters. Further reference to the Government's request is given in the Introduction and in Appendix A to this report.

While not included among the specific matters on which the Government requested advice, a related matter, the adequacy of Alberta's reserves of surface mineable subbituminous coal to meet market requirements, has also been studied by the Board. The Board is issuing its report and recommendations on this matter concurrently with the present report.

SUMMARY

A. STATUS

1. After more than a decade of progressive decline, the Alberta coal industry, has regained a position of importance and now ranks as the third largest extractive industry in the Province. The main factors which contribute to this renaissance are

(a) a growing Alberta demand for thermal coal for power plant fuel,

(b) an expanding market for metallurgical coal particularly in Japan,

(c) a shift from a multiplicity of small mines to a few large efficient mining complexes,

(d) adoption of surface mining in place of underground mining, and

(e) extensive mechanization, with consequent very large gains in productivity.

2. Production of marketable coal increased over the period 1963 to 1972 from 2.3 to 9.0 million tons. Output in 1972 was 4.9 million tons of thermal coal and 4.1 million tons of marketable metallurgical coal. In total, the 1972 production was valued at approximately $50 million.

3. Capital investment since 1963 in coal mining facilities and coal processing plants is estimated at about $160 million of which some 55 per cent, or $85 million, have been spent on supplies and services within Alberta.

4. Current annual operating expenditures of the coal industry are estimated to be about $40 million, of which 80 per cent, or $32 million, are expended on supplies and services purchased in Alberta. In addition to the above, an estimated $3 million is now spent annually on coal exploration in the Province.

5. Some $40 million have been invested in new or expanding railway facilities for the shipment of Alberta metallurgical coal to the Pacific Coast enroute to Japan. Annual operating expenditures incurred in connection with transportation and dock-side operations in 1972 total approximately $12 million, of which approximately 80 per cent is spent within Alberta. Revenues received by Canadian National, Canadian Pacific and the Alberta Resources Railroads from coal haulage in 1972 amounted to about $7.4 million, $4.0 million and $0.9 million respectively.

6. Approximately 1,900 persons were directly employed in the Alberta coal industry in 1973. Indirect employment within communities affected by the coal industry extended to about 1,050 persons.

7. Direct revenues to the Alberta Government in 1972 totalled $2.40 million for lease fees, rentals and royalties. In addition, some $0.96 million in Alberta personal income taxes were attributable to the coal industry, increasing the total direct revenues to the Alberta Government to nearly $3.4 million. Government revenues from corporate taxes resulting from the coal industry are not available but are expected to be negligible.

B. OUTLOOK

1. From projected demand for electric energy in Alberta, the Board concludes that annual production of thermal coal for use within the Province will rise from 4.9 million tons in 1972 to approximately 9.4 million tons in 1978 and 14.0 million tons in 1982. The Board anticipates that by 1982, an additional 10 million tons annually of Alberta thermal coal from the Foothills Region may be moving to Ontario electric utility markets.

2. A significant coal requirement for gasification is not expected to develop until some time after 1983.

3. It is anticipated that in response to demand for thermal coal, up to six new mines will have to be developed by 1982. Two new mines are expected to be required in the Plains Region to meet Alberta's requirement for electric energy generation, and four new mines in the Foothills Region to meet the demand from Ontario. All are expected to be surface mining operations.

4. Production of marketable metallurgical coal is expected to increase from 4.1 million tons in 1972 to 19 to 20 million tons in 1982. The major portion of this output will be destined for Japanese markets, and the remainder for markets in Ontario, Europe and South America.

5. Increased demand for metallurgical coal are expected to be met partly through expanded production from existing mines, but will also require development of six new sites in the Mountain Region. Although most of these sites are expected to be surface mines, it is quite possible that some underground mining will be involved. Each of these will also necessitate a coal processing plant.

6. Based on current projections, the Board estimates that the coal industry will invest nearly $800 million directly in new capital facilities to 1982, and that a further $300 million will be spent in this period on improvements to transportation facilities.

7. Combined annual operating expenditures incurred by mines and processing plants are estimated to inject upwards of $1.6 billion into the Provincial economy over the next 10 years.

8. Total direct employment in the Alberta coal industry is expected to rise from 1,900 persons in mid-1973 to 6,100 in 1978 and 9,300 in 1982. Indirect employment generated by an increase in coal activity in neighbouring communities will correspondingly provide jobs for an additional 4,300 people over the next 10 years.

9. Revenues to the Government of Alberta from lease fees, lease rentals and royalties will increase in proportion to coal production and increases in royalty rates. Alberta corporate and personal income taxes attributable to the coal industry will grow in proportion to industry production and sales.

C. RECOMMENDATIONS

Based on evidence presented in this report, the Board has prepared a list of recommended actions which it believes would facilitate further orderly development of Alberta's coal resources in the public interest. A more detailed exposition of these recommendations, listed below, is found in Section 12:

1. a clear definition of land use policies for Foothills and Mountain Regions;
2. guidelines on land reclamation;
3. determination of expected manpower needs and establishing of training programs;
4. community planning initiatives;
5. government assistance to coal mining technology;
6. development of more effective marketing methods;
7. review of the royalty rate on both thermal and metallurgical coal;
8. consideration of the economic viability of new proposals.

1 INTRODUCTION

By Order in Council numbered O.C. 289/73, dated February 22, 1973, a copy of which is attached to this Report as Appendix A, the Government of Alberta requested the Energy Resources Conservation Board to inquire into and report upon the current and future impact of the Alberta coal industry on the economy of the Province and to advise on a number of specific matters.

Pursuant to this request, the Board invited submissions from the industry and other interested parties by Informational Letter No. IL-C 73-3, which is reproduced in Appendix B, and, following publication of notice, heard representations respecting matters within the purview of the inquiry at a public hearing in Calgary on June 19 to 21, 1973, with G. W. Govier, P.Eng., D. R. Craig, P.Eng., and N. Berkowitz sitting.

The companies that provided submissions in these proceedings and their representatives and witnesses are listed in Table 1-1. The highlights of the submissions are given in the following sections:

1.1 Views of the Participants

1.1.1 CanPac Minerals Limited

CanPac's submission to the hearing dealt with the company's corporate structure, its corporate ownership, its historical and projected exploration programs, and its involvement in coal mining and processing, and briefly discussed its outlook of potential markets for Alberta coal. It noted that the company spent $3.7 million on exploration of thermal and metallurgical coal reserves between 1963 and 1973 and that it expected to spend some $6.1 million on such activity in the period 1974 to 1983. A cost breakdown showed that some $1.9 million were recently expended on one of CanPac's major coking coal properties in preparation for commercial development when a sales contract

Table 1-1

PARTICIPANTS

	Representatives	Witnesses
CanPac Minerals Limited (CanPac)*	J. G. Matthews, P.Eng.	J. G. Matthews, P.Eng. R. T. Marshall H. G. Rushton, P.Eng.
The City of Edmonton (City of Edmonton)*	V. Kondrosky, P.Eng.	V. Kondrosky, P.Eng.
Calgary Power Ltd. (Calgary Power)*	D. O. Sabey, Q.C.	T. D. Stanley, P.Eng. G. Alexander
Electric Utility Planning Council (EUPC)*	D. O. Sabey, Q.C.	T. D. Stanley, P.Eng. H. D. Johnson, P.Eng.
Pan-Alberta Gas Ltd. (Pan-Alberta)*	R. J. Ludgate	
Pegasus Experimental Metals and Mining Ltd. (Pegasus)*	A. Fennell	A. Fennell
Alberta Power Limited (Alberta Power)*	B. V. Massie, Q.C.	G. Paicu, P.Eng.
The City of Calgary (City of Calgary)*	H. D. Hunter, P.Eng.	
Manalta Coal Ltd. (Manalta)*	E. J. Panchysyn, P.Eng.	E. J. Panchysyn, P.Eng.

* Abbreviation of name used throughout report.

Table 1-1 (Cont'd)

	Representatives	Witnesses
McIntyre Porcupine Mines Limited (McIntyre)*	R. A. Hislop D. Nelson	R. A. Hislop
The Canmore Mines, Limited (Canmore)*	H. G. Stephenson, P.Eng. D. Mitchell	H. G. Stephenson, P.Eng.
Century Coals Limited (Century)*	O. H. Patrick	O. H. Patrick
Consolidation Coal Company of Canada (Consol)*	B. V. Massie, Q.C.	M. S. Cholach, P.Eng.
Denison Mines Limited (Denison)*		
Alberta Federation of Labour (Federation of Labour)*		
Luscar Ltd. (Luscar)*		

---

* Abbreviation of name used throughout report.

is negotiated. Approximately 75 per cent of these funds were spent on exploration, 8 per cent on reclamation of exploration sites, 9 per cent on off-property costs such as consulting and sample analyses, and the remaining 7 per cent covered lease rental charges.

Exploration of one of CanPac's thermal coal deposits, completed in the mid-1960's, incurred total expenditures of $431,000 of which 38 per cent was for exploration, 12 per cent for off-property costs, and 50 per cent for lease rentals. CanPac indicated that reclamation costs associated with exploration of thermal coal properties are generally minor.

Although the company is not currently involved in coal production in the Province, CanPac did provide some information about investment requirements and employment potentials associated with an operation designed to produce 2 million tons of coking coal per year.

During the next 10 years CanPac expected Alberta coking coal to be marketed primarily in Japan; but thought that markets might also develop in Ontario, the mid-western United States, South America, and Europe.

Use of non-coking (thermal) coal was, during the forecast period, expected to remain confined to generation of electric energy within the Province. Extraprovincial markets for such coal were only considered likely to develop sometime thereafter.

1.1.2 The City of Edmonton

The City of Edmonton's submission noted that the City's coal rights in the Genesee area held some 189 million tons, of which 57 million tons were estimated in 1970 to be recoverable at an average cost of $2.45 per ton.

1.1.3 Calgary Power Ltd.

Calgary Power, a Canadian owned and controlled electric utility, discussed its use, since 1962, of subbituminous coal

in thermal generating plants at Wabamun. It forecast that annual coal requirements for generation of electric energy in Alberta will increase from 3.7 million tons in 1973 to 13.4 million tons by 1983. A significant portion of this requirement will be met from new mines starting in 1979.

Calgary Power anticipates some improvement in equipment and transportation systems associated with coal mining during the forecast period, but does not expect fuel conversion technology (such as coal gasification) to influence its planning of generating facilities prior to 1983. It expects that escalating natural gas prices will exert upward pressures on the price of coal from new mines.

Calgary Power's expenditures on exploration between 1970 and 1972 totalled some $440,000, and over the next 10 years the company anticipates spending an average of $200,000 per year on such activity. Its exploration program in the Lake Wabamun area has confirmed a reserve of 70 million tons at the Whitewood mine and some 310 million tons in lands leased by the company at the Highvale mine. To reach current production levels, some $13.5 million have been invested in plant and equipment at these mines. Further investment in existing and new mines to 1983 is projected at some $85 million, of which 40 per cent are expected to be expended on goods and services originating in Alberta. Total operating expenditures of Calgary Power's existing mines in the period 1963 through 1972 amounted to $22.4 million, and are forecast to increase to $175.5 million between 1973 and 1983. Calgary Power estimated that about 90 per cent of these operating expenditures were spent on goods, supplies, and services purchased in Alberta. Employment at the company's mines rose from 48 men in 1963 to 153 men in 1972; and total employment in mining operations necessary for meeting projected generation requirements in 1983 was estimated at some 650 persons.

Investment in coal processing plants at the Whitewood and Highvale mines to date amounts to some $7.5 million. New processing facilities and additions to existing plants between 1973 and 1983 are projected to cost $38.7 million, with virtually the entire sum spent in Alberta.

1.1.4 Electric Utility Planning Council

The EUPC, which represents all the Alberta electric utility companies, submitted a brief dealing with marketing and transportation of coal used for generation of electric energy, and with the prospects of fuel conversion technology within the forecast period.

The EUPC noted that coal requirements for electric energy generation in Alberta had increased from 570,000 tons in 1963 to some 4.5 million tons in 1972. Cumulative consumption over the 10-year period totalled about 22.8 million tons. On the assumption that all future power plants would be coal-fired, it projected the rate of annual consumption to increase to about 19 million tons by 1983 and 71 million tons by 2001. While the EUPC appeared confident that the price of coal from existing mines supplying the power plants would escalate only moderately, it was concerned that coal from new mines would, in the short term, tend to be priced competitively with oil, and later follow either oil or equivalent nuclear fuel prices. It believes, therefore, that some "means should be established to ensure that adequate supplies of coal, at reasonable cost, should be dedicated to electric power generation". The EUPC noted that although development of other than conventional electric energy generation methods will affect potential markets for coal, it did not believe that such methods will become commercially feasible before the 1990's.

1.1.5 Alberta Power Limited

Alberta Power, and its predecessor Canadian Utilities, Limited, is an electric utility which has operated in Alberta since 1927, and uses primarily coal to meet electric energy demands in its service area. The company projects its 1973 coal requirement of 1.2 million tons to rise to 1.8 million tons by 1978 and anticipates that this requirement will be met from mines adjacent to its existing generating stations. It generally supports the views of the EUPC on protection of coal supplies for future Alberta consumption.

1.1.6 Manalta Coal Ltd.

Manalta, an Alberta based corporation, forecast that production of subbituminous coal in the Province, mainly for local consumption, would increase to 18 million tons by 1982, and that production of coking coal for Japan and Europe would rise from 3.8 million tons in 1972 to 6.7 million tons in 1982. It suggested that coal gasification in Alberta is unlikely before 1983, and assumes that technological advances in coal transportation and other factors bearing on coal marketing patterns would not significantly affect the structure of the industry before the end of the forecast period.

Coal exploration activities by Manalta over the 10-year period to 1972 have incurred capital investments of $400,000 and operating expenditures of $3.2 million, and provided some 120 man-years of direct employment. Of the operating expenditures, some $1.8 million went to goods, supplies, and services purchased in Alberta.

Mining activities by Manalta, excluding processing but including transportation, have required capital investment of some $2.7 million to 1973. Over the next 10 years, some $55 million are expected to be invested in new mining ventures.

Operating expenditures associated with mining were estimated at $13.5 million annually to 1983, with some 40 per cent of that total spent on Alberta goods and services. By 1983, direct employment for some 570 people is anticipated.

Investments in processing plants by Manalta in the period 1963 to 1972 were shown to be $350,000 and forecast to total some $15 million during the next 10 years. Operating expenditures of projected coal cleaning plants were estimated to run at an average of $3.2 million per year and the plants were expected to provide direct employment for 35 men. Expenditures for Alberta goods and services associated with processing activity commencing in 1976 were estimated at $1.1 million per year, or about 34 per cent of total annual operating expenditures.

1.1.7 Denison Mines Limited

The submission by Denison focused attention on most of the matters about which the Board sought information, but was particularly helpful in giving details of the company's proposed hydraulic mine. The firm was not represented at the hearing.

Exploration activity related to this venture was expected to incur annual expenditures slightly in excess of $250,000 over the forecast period, and to provide annual employment for some 25 people. Capital investments in exploration are projected at $300,000 to 1983. The mining activity is expected to require capital investments of some $8.5 million during this period, demand an annual operating expenditure of $6 million at full production, and provide direct permanent employment for 220 persons. Some 60 per cent of the total capital and operating expenditures of $51.5 million associated with the mining activity were forecast to be for goods and services purchased in Alberta.

Processing of coal from the projected mining venture would require capital investments of $7.5 million and an annual operating budget of $1.5 million, and provide direct permanent

employment for 30 persons. Some 50 per cent of these expenditures would be for goods and services from Alberta.

The transportation component of Denison's proposed operation was expected to require a $16 million capital investment, incur annual operating expenditures of some $6.7 million at full production, and offer continuous employment to 190 persons. Some 55 per cent of the capital and annual expenditures were estimated to be for goods, supplies, and services purchased in Alberta.

In summary, Denison indicated that expenditures associated with exploration, mining, processing, transportation, and support services for its mine with 1 million tons a year output will entail a total capital expenditure of $29 million and operating costs of $167 million for the period 1969 to 1980.

1.1.8 Alberta Federation of Labour

The submission of the Federation of Labour to the hearing recommended that the industry place greater emphasis on underground mining, and that equitable standards of conservation and reclamation be maintained in the industry. The Federation of Labour did not have a representative at the hearing.

1.1.9 McIntyre Porcupine Mines Limited

McIntyre's submission outlined the firm's involvement in the creation of the Town of Grande Cache as a domestic base for its employees. Some $2.6 million were provided towards the cost of physical facilities, and in addition the company gave a 10-year guarantee for some $8.9 million in mortgages secured through various agencies. In order to encourage employees to purchase homes, McIntyre's policy is to sell serviced homes at cost price and to subsidize the monthly payments for a considerable period of time.

McIntyre favoured the use of the Alberta Resources Railway as a means for developing agricultural and other resource

production in the Peace River Country, and suggested that the government actively participate in promoting tourism in the Grande Cache area.

1.1.10 The Canmore Mines, Limited

The submission by Canmore detailed its corporate history in relation to the total coal industry of Alberta. Although sizeable reserves still exist in its area, the firm is somewhat handicapped by its low annual potential production level, and an inability to market the coal elsewhere than in Japan. Canmore was optimistic, however, that changes in freight rates and the success of its coal devolatilization process will allow it to enter Eastern Canadian and European markets, and so increase its current production of 160,000 tons per year to a more viable level of 550,000 tons per year by 1977. Employment necessary to allow such increased production was projected to rise from 158 to 245. Canmore anticipated some difficulty in recruiting suitable employees for future underground mining in the Province, and noted that successful recruiting will likely hinge on the availability of suitable housing for prospective miners.

1.1.11 Century Coals Limited

Century markets coal from its sub-surface Atlas Coal Mine at East Coulee exclusively for residential consumption. Diminishing demand for its product and high transportation costs have caused output to decline progressively since 1955 and created considerable economic hardship in communities near Drumheller. Century's submission noted that existing reserves, particularly suitable for longwall mining, could meet long term contracts for 750,000 tons per year at a mining cost of 25 to 28 cents per million Btu, and that its coal would also be suitable for coal gasification.

1.1.12 Luscar Ltd.

Luscar's brief dealt qualitatively with the economic benefits which the Provincial economy derived from coal activity, and discussed a number of problems currently facing the industry. The company attached particular significance to the prospect for new employment which was estimated at 400 to 500 new (direct and indirect) jobs for every million tons of additional coal production. Luscar suggested that the most formidable problems of the Alberta industry arose from its inability to diversify extra-provincial markets because of high freight rates, because of the lower heat value of local thermal coals, and because of advantages of foreign competitors in these markets. It also pointed out that shortages of skilled labour will be aggravated by future expansion of the industry. Luscar did not provide a representative at the hearing.

1.1.13 Consolidation Coal Company of Canada

Consol has been engaged in coal exploration and mining in Alberta since 1968. Although mining operations are being conducted by a subsidiary (Cardinal River Coal Ltd.), Consol's direct exploration expenditures over the past 5½ years have totalled some $2.6 million and are expected to average about $500,000 annually between now and 1983. Consol advised the Board that this exploration is primarily directed towards the eventual development of metallurgical coal for export markets.

1.1.14 Pegasus Experimental Metals and Mining Ltd.

The main aspects of the evidence provided by Pegasus dealt with its claim of development of a unique coal gasification process which allows production of a "synthetic" pipe line gas at a 1970 cost of 57 cents per million Btu (including 22 cents per million Btu for the feed coal). At the hearing the company stressed that full scale commercial application of the process would be conditional on negotiation with and receipt of certain unspecified assurances from Provincial authorities.

1.2 Board Staff Discussions and Visits

Where necessary, and in order to augment the information available to the Board after the conclusion of the hearing, members of the Board's staff subsequently held further discussions with personnel of companies producing coal or engaged in exploration, transportation, marketing, or other facets of coal activity. They also visited a number of municipalities in or near which mining or coal processing operations are being conducted. (These included Bellevue, Blairmore, Cadomin, Canmore, Coleman, Forestburg, Frank, Grande Cache, Hinton, Seba Beach, and Wabamun in Alberta; and Elkford and Sparwood in British Columbia.) Consultations were also held with officials of the regional planning commissions of Battle River, Oldman River, and Parkland; and the Provincial Planning Branch of the Department of Municipal Affairs. From these visits and consultations, data were obtained from which the community impact of coal operations could be assessed.

1.3 Cost Data and Production Figures

For the purpose of this report, all cost data other than those relating to activities prior to 1972 are expressed in 1972 terms. Expenditures up to and including 1972 are expressed in actual dollars, regardless of the purchasing power of the funds in the years in which they were expended. Statistical data are complete to 1972; but wherever possible, preliminary data for 1973 are included in text and figures. All coal quantities are expressed in short tons.

2 HISTORICAL REVIEW

The history of the Alberta coal industry is characterized by three distinct major phases, a period of development growth to 1950, drastic decline between 1950 and 1962, and a renaissance beginning in 1962 and continuing to the present.

In the southern Alberta Plains, easily accessible coal is so abundant, and coal outcrops are so common, that early settlers in the Province undoubtedly dug coal long before mining became an organized industrial activity. There is evidence that coal was fairly widely used in the Fort Edmonton area as early as 1850; and bootleg operations, often going beyond personal needs to meet local domestic fuel requirements, were common from about 1875 on. (In later years, such operations, popularly known as "snowbirds", became so widespread as to cause legitimate Plains coal producers considerable economic problems). However, even as a regulated activity, coal mining in Alberta has a history reaching back to well before the end of the 19th century. The first recorded coal mines in the Province were opened at Coal Banks (later renamed Lethbridge) in 1874, at Canmore in 1886, and at Anthracite (near Banff) in 1888. By 1903, mining had so increased that no fewer than 30 separate mines, each producing between 3 and 30 tons per day, were then reportedly active in the Edmonton area alone.

The initial impetus for these developments came from the fuel needs of growing towns and rural communities. But from 1885 on, as railway construction advanced, progressively larger quantities of coal, ultimately reaching 3 million tons annually, were also required for fuelling of steam locomotives. And by the mid-1920's, a distincitve Alberta coal industry had come into being and continued to play a major economic role in the Province until the end of the 1940's. Figures 2-1, 2-2 and 2-4 illustrate this with statistical data on employment, production, and value for the years to 1950; and Figure 2-3, which

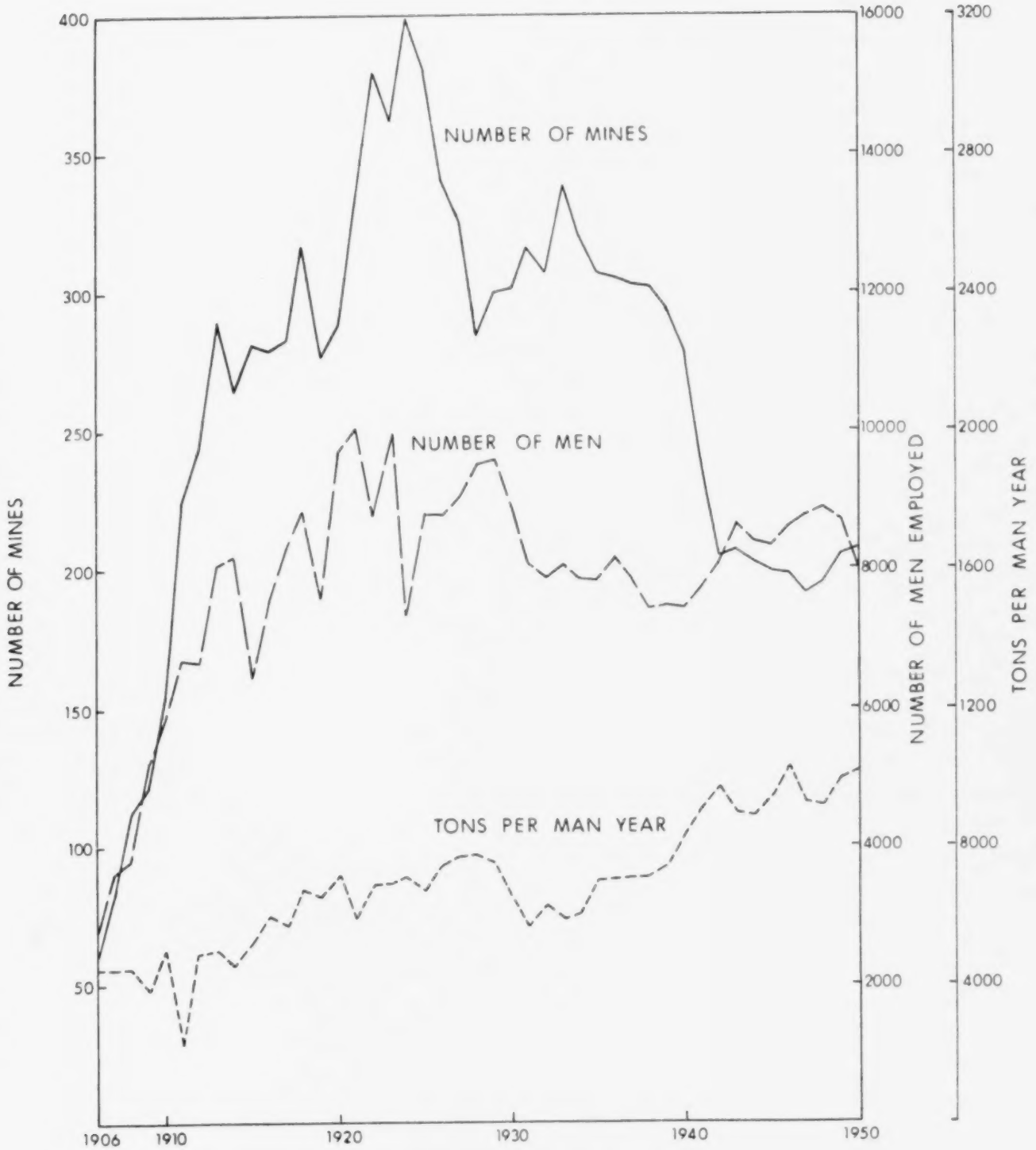


FIGURE 2-1 EMPLOYMENT AND PRODUCTIVITY IN ALBERTA COAL MINES
1906 - 1950

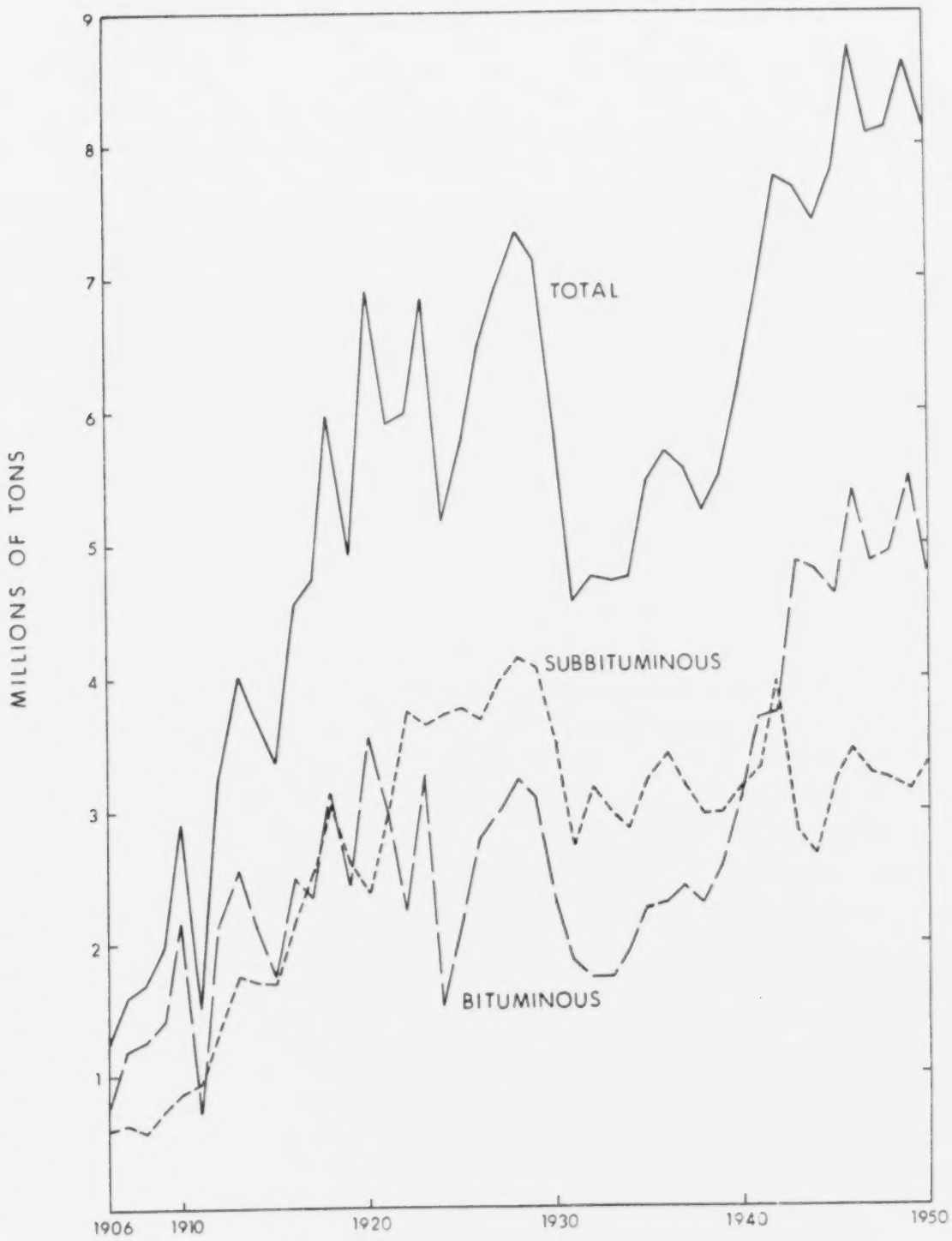


FIGURE 2-2 ANNUAL PRODUCTION OF RAW COAL IN ALBERTA 1906 - 1950

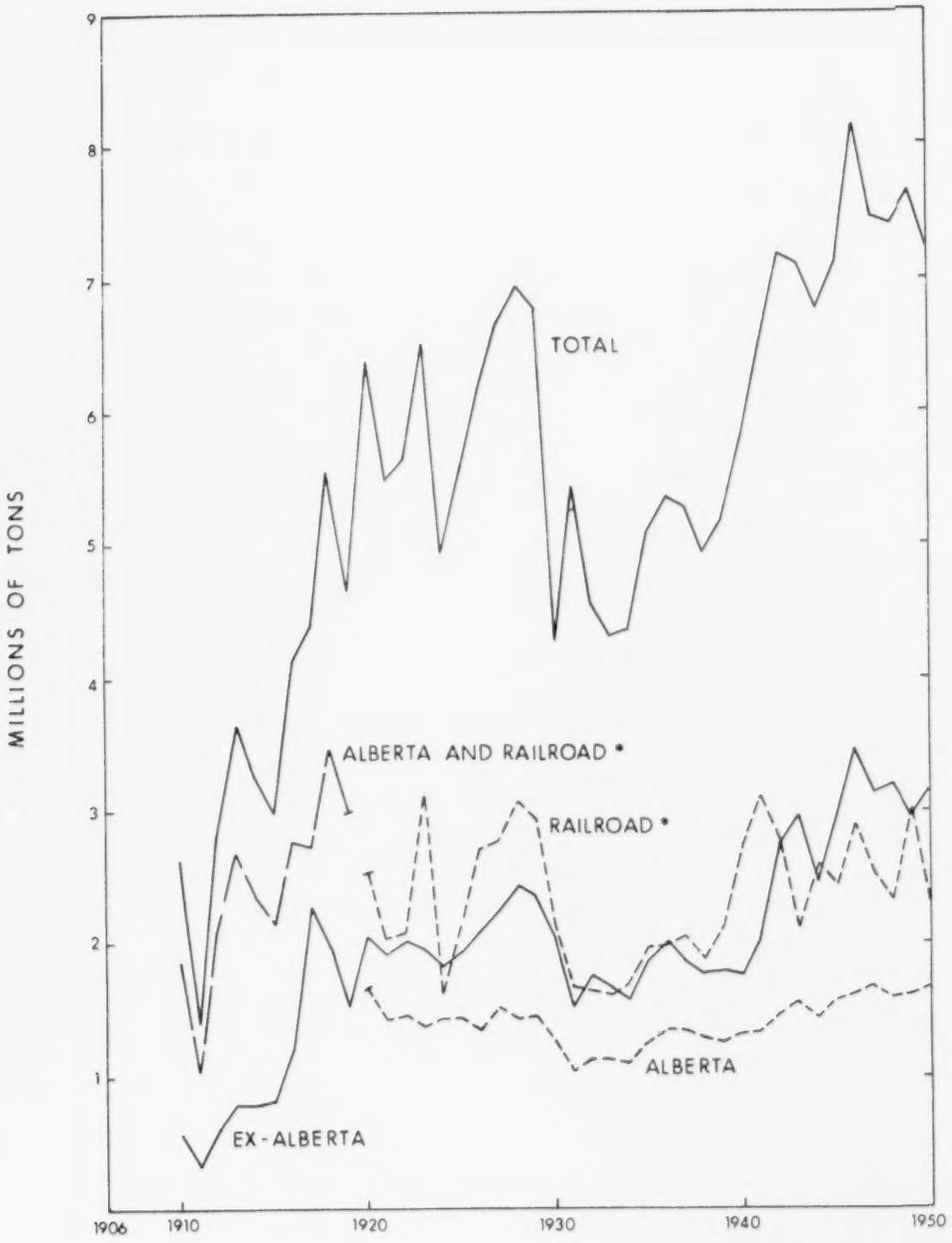


FIGURE 2-3 ANNUAL DISPOSITION OF MARKETABLE ALBERTA COAL 1906 - 1950

* RAILROAD CONSUMPTION IN AND EX-ALBERTA

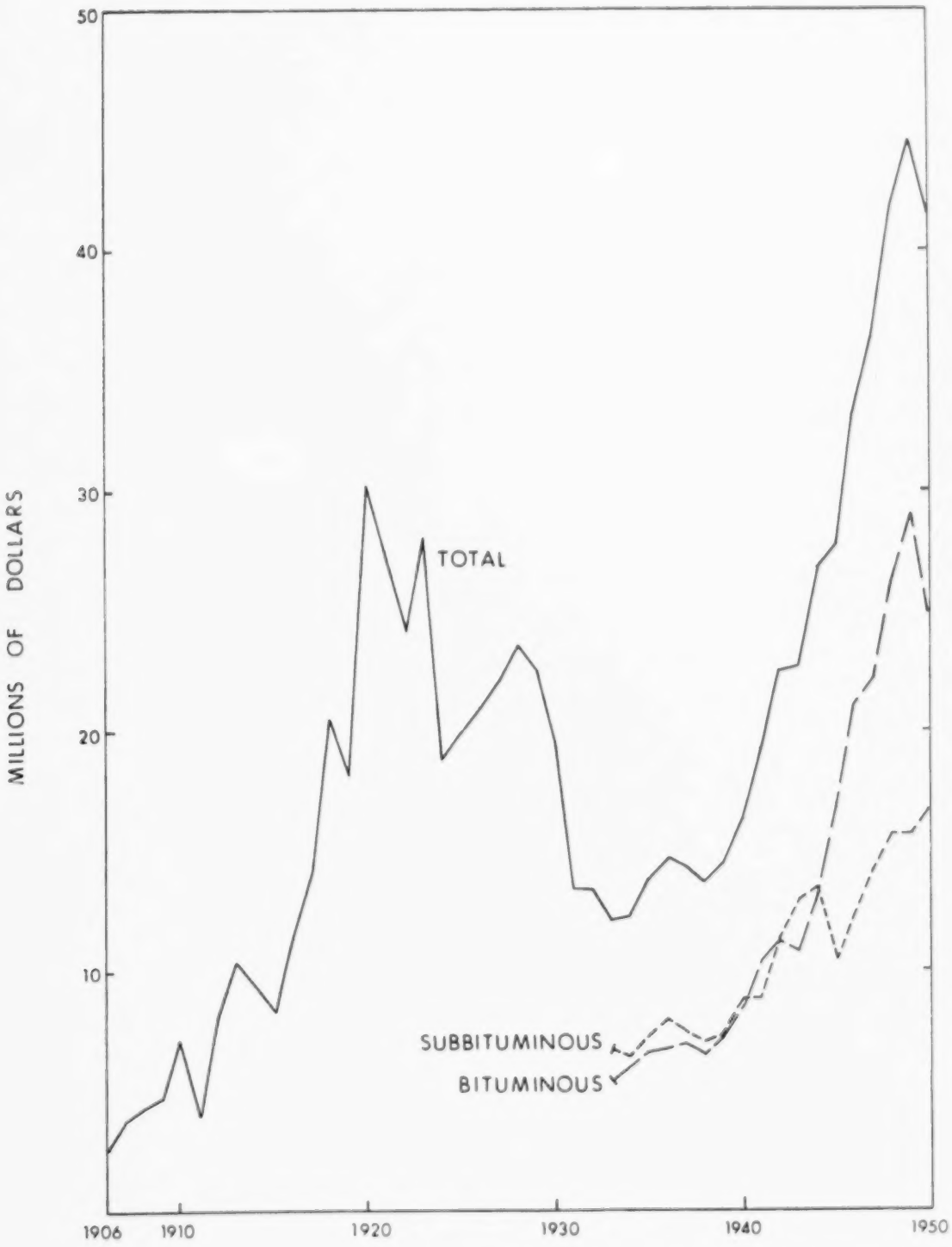


FIGURE 2-4 ANNUAL VALUE OF MARKETABLE COAL IN ALBERTA 1906 - 1950

summarizes the disposition of Alberta coal to 1950, indicates the magnitude of the export markets which had developed, mainly through railway fuelling needs.

In all instances, mining was at first carried on by conventional underground room-and-pillar methods which allowed up to 45 per cent recovery of in-place reserves, depending on local geological conditions and demand for particular sizes of coal. In the Plains, this began to be augmented in the 1910's by surface mining which usually involved overburden removal by horse-drawn scrapers; by the mid-1940's, open pit operations had also become prominent in the Foothills and Mountain regions.

However, the great majority of mines consisted of very small workings, mostly designed to serve local markets, and were often operated by farmers as spare time ventures during winter seasons. In 1923, a peak period between the end of World War I and the onset of the Depression, 293 out of 362 mines thus produced on average less than 1,100 tons each, and together accounted for only 4.6 per cent of total production. Even as late as 1949, 144 of 204 reported active mines furnished less than 5 per cent of that year's coal output. Moreover, as indicated in Figure 2-5, which shows year by year mine openings and abandonments, most mines had very short lives, and many, in fact, were opened and abandoned in a single year. A fragmented industrial organization which reflected the narrow local interests of many producers[1] coupled with the fact that few mine operators had the financial resources or the willingness to adjust to changing market conditions, meant that an inherent instability existed which greatly weakened the industry. Questions about its competitive position and its reliability as a long-term supplier of fuel were, in fact periodically raised in many quarters as early as the mid-1920's.

---

[1] For example, in the mid-1940's, there existed a Western Canada Coal Operators' Association, a Domestic Coal Producers' Association, and a Drumheller Coal Operators' Association whose diverse interests made for considerable conflict and rarely allowed an effective presentation of the collective interests of the Alberta coal industry.

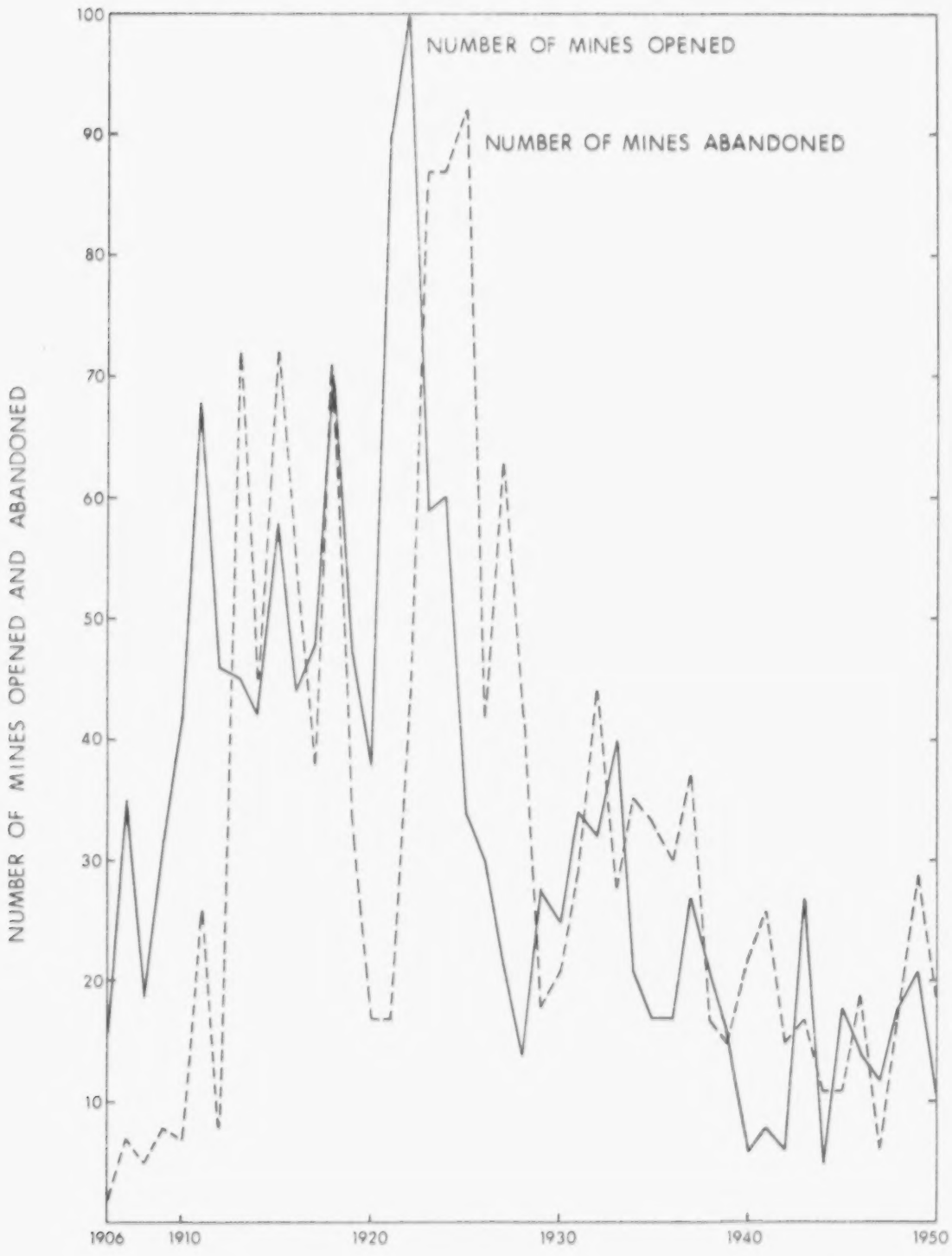


FIGURE 2-5 ANNUAL NUMBER OF COAL MINES OPENED AND ABANDONED IN ALBERTA 1906 - 1950

At the beginning of the 1950's, competition from indigenous oil, natural gas, and propane captured coal's traditional railway and domestic markets, and the industry was forced into a steep progressive decline which almost completely extinguished it.

The Board notes that this decline was not visibly slowed by Federal subvention aid, which from 1928 on was used to offset part of the coal production transportation costs and so enable Canadian coal to compete against imported fuels in Central Canadian markets. Subvention payments were discontinued in 1971 as demand for Canadian metallurgical coal in Japan and increasing requirements of subbituminous coals for local generation of electric energy seemed to allow economically viable production without such public assistance. Between 1928 and 1971 some $49 million were spent on movement of approximately 22 million tons of coal from Alberta, with payments ranging from a high of $5.96 per ton in 1928 to between $2.50 and $3.50 per ton in the mid-1960's.

Similarly, the decline progressed largely unrestrained by the industry's belated efforts to improve its competitive position through mine mechanization and expansion of surface mining, or by public expenditures on research directed towards development of alternative coal markets. The Government of Alberta increased its expenditures, through the Research Council of Alberta, on coal research and particularly on research directed towards the development of new markets. This is shown in Figure 2-10. Notwithstanding, the demand for Alberta coal continued to shrink. The resultant collapse of the industry, and its subsequent resurgence from 1962 on, is illustrated by the production, disposition and value statistics shown in Figures 2-7, 2-8 and 2-9.

The renaissance of the coal industry in Alberta had its beginning with the coming on stream of the Calgary Power coal-fired electric power plant at Wabamun in 1962, and was enhanced

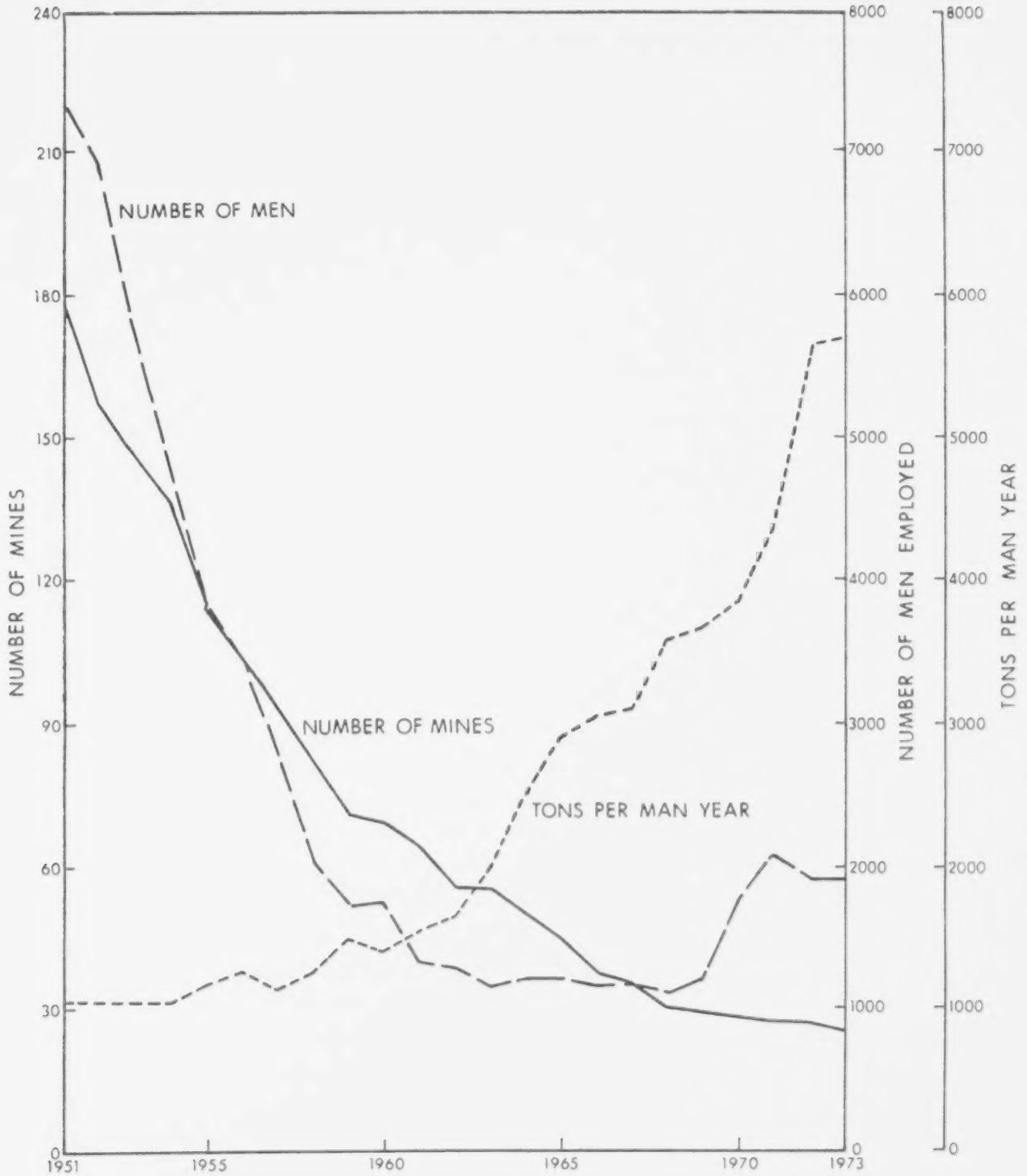


FIGURE 2-6 EMPLOYMENT AND PRODUCTIVITY IN ALBERTA COAL MINES
1951 - 1973

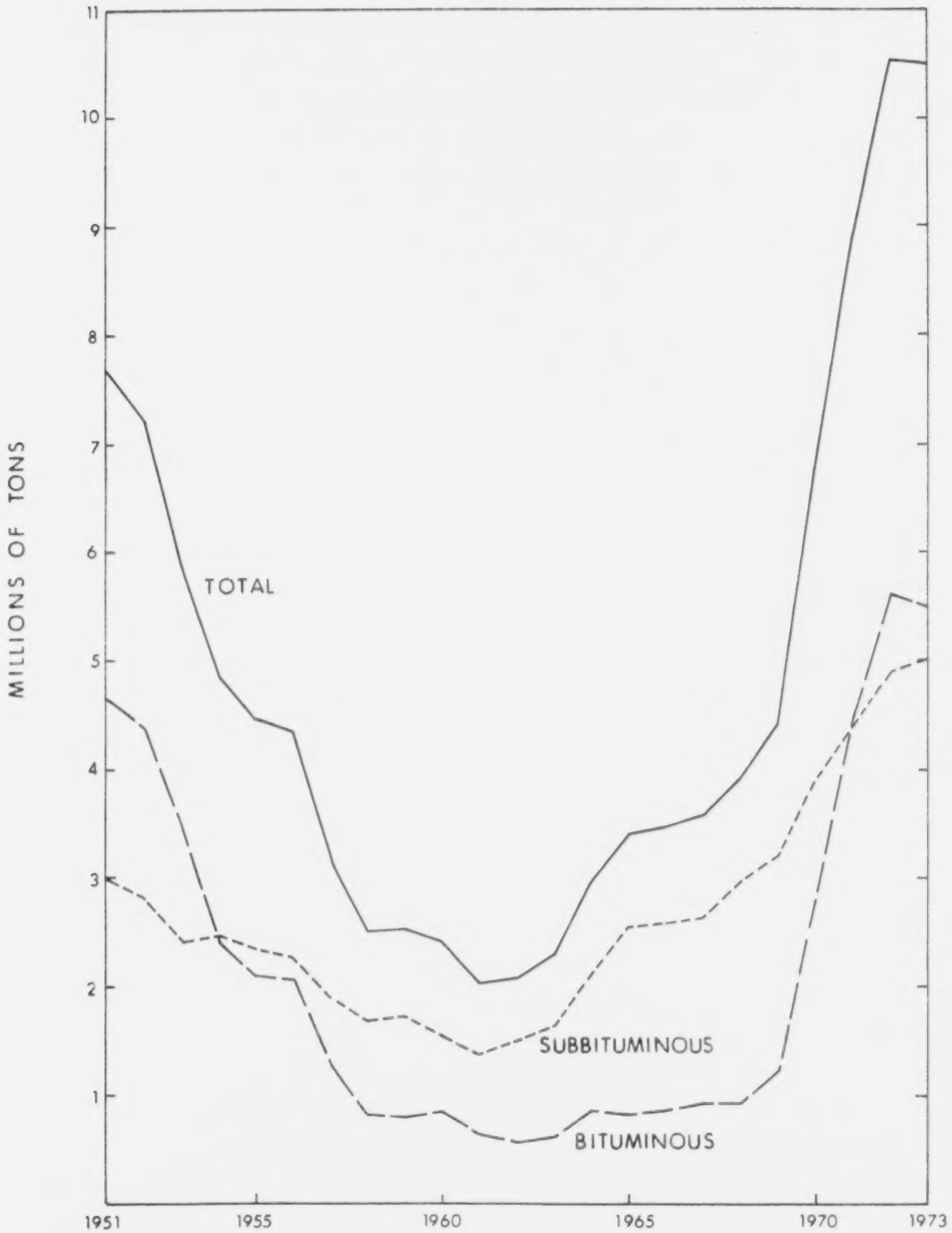


FIGURE 2-7 ANNUAL PRODUCTION OF RAW COAL IN ALBERTA 1951 - 1973

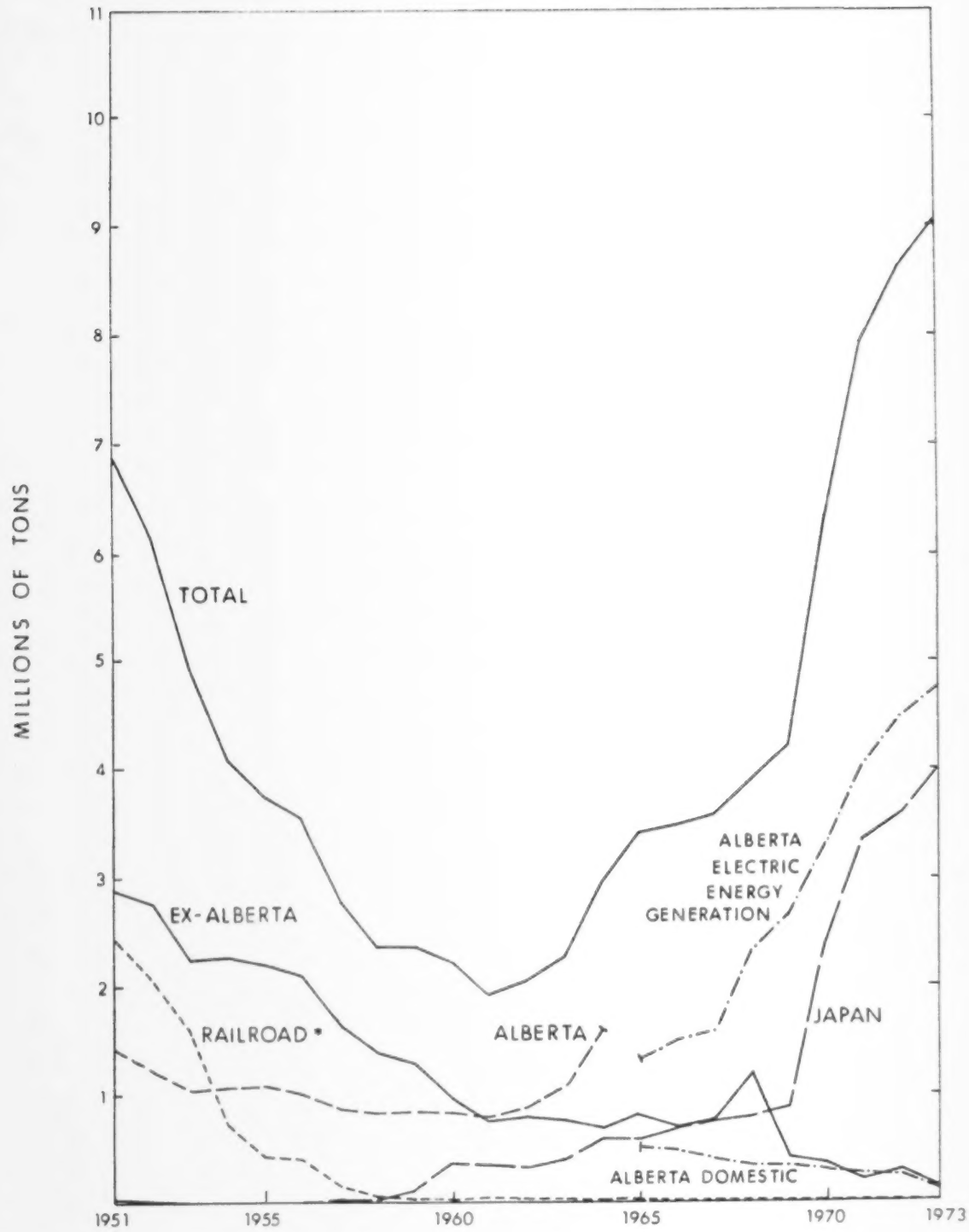


FIGURE 2-8 ANNUAL DISPOSITION OF MARKETABLE ALBERTA COAL 1951 - 1973

* RAILROAD CONSUMPTION IN AND EX-ALBERTA

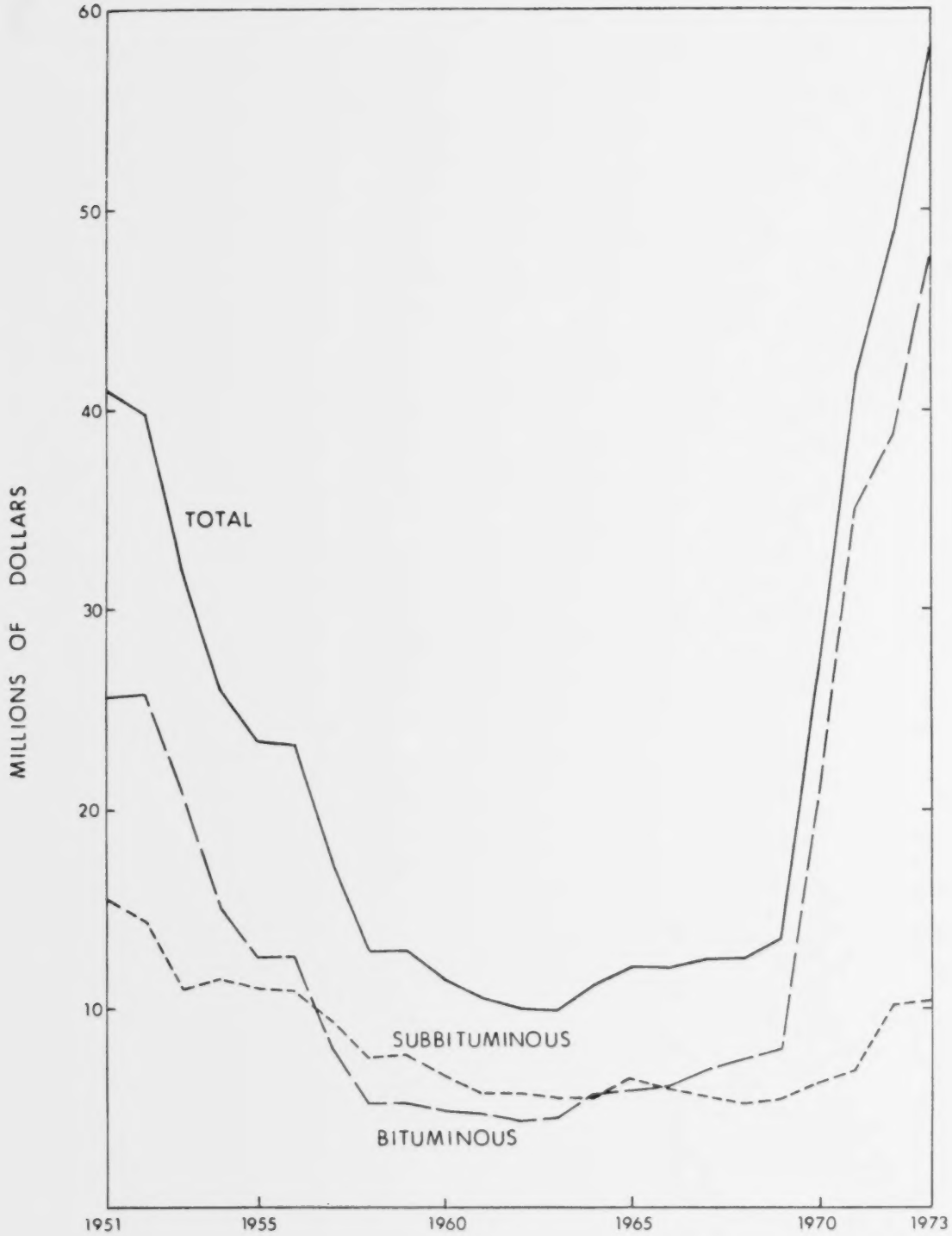


FIGURE 2-9 ANNUAL VALUE OF MARKETABLE COAL IN ALBERTA 1951-1973

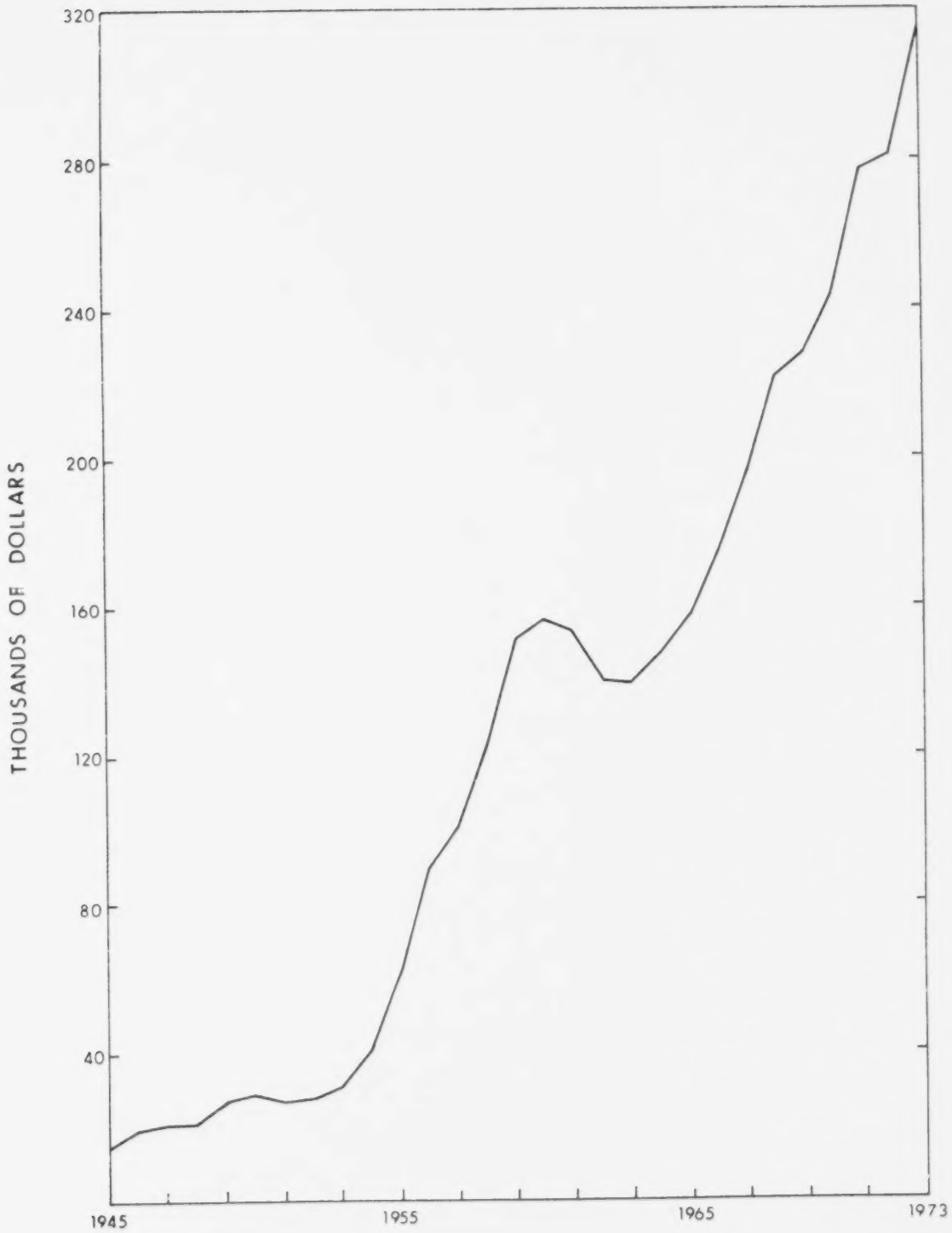


FIGURE 2-10 ANNUAL PUBLIC EXPENDITURES ON COAL RESEARCH AND DEVELOPMENT IN ALBERTA 1945 - 1973

in the late 1960's by the signing of several long-term contracts for the delivery of metallurgical coal to Japan. Consolidation of the industry through innumerable mine closures and adoption of large scale surface mining bore directly on such events. On the one hand, important from a mining as well as a resource conservation standpoint, consolidation improved extraction efficiencies from a maximum 40 to 50 per cent achieved in underground operation to better than 80 per cent; and on the other, even more profoundly important for the industry, it multiplied productivity. As shown in Figure 2-6, output per man-year climbed from about 1,200 tons in the mid-1950's to almost 3,000 tons in the early 1960's, and now stands at approximately 5,500 tons. Alberta's coal industry has re-established itself at home over the past few years and is taking advantage of an increasing overseas demand for coal, particularly in Japan. This has been due to increases in the cost of alternative fuels in the early 1960's and improved transportation systems afforded by introduction of unit trains along with increased productivity and extractive capability.

Indications are that coal will regain and substantially enlarge its traditional role, and invade other markets, as shortages of moderately priced natural gas become acute and uncertainties of future oil supplies are more strongly felt.

3 DISTRIBUTION AND RESERVES OF COAL

3.1 Distribution

Coal is exceptionally widely distributed throughout the Province, although primarily in the area south of Lat. 56°. Coal-bearing strata underlie some 113,000 square miles or about 45 per cent of Alberta (see Figure 3-1). Each of Alberta's three physiographic domains (Plains, Foothills and Mountain Regions), offers different types of coal.

Approximately 91 per cent of the total area underlain by coal formations lie within the Plains Region. Subbituminous coal, often in the form of distinctive coal zones, occurs in laterally persistent coal zones associated with the Upper Cretaceous Belly River Group and Horseshoe Canyon Formation, and with the Upper Cretaceous/Lower Tertiary Paskapoo Formation. True seam thicknesses vary up to 12 feet; and except for a slight southwesterly dip into the Alberta Syncline, whose axis parallels the trend of the Rocky Mountains, the seams lie substantially flat. In the Cypress Hills area, in the extreme southeast of the Province, the Tertiary strata also contain some small, presently uneconomic, deposits of lignite.

In the Foothills Region, the coal is classed as high-volatile bituminous and is associated with the Cretaceous Wapiti Group as well as with the Belly River and St. Mary River formations. In the Mountain Region, low- and medium-volatile bituminous coals occur in the Upper Jurassic/Lower Cretaceous Kootenay, Luscar, and Commotion Formations. In both these regions, the coal-bearing strata are highly folded and frequently faulted, so that repetition of rock sequences is common. Because of local thickening, some seam thicknesses are greater than 40 feet. Alberta coals are notably low in sulphur content, which ranges from 0.2 to 0.7 per cent.

The principal characteristics of the various coal types

and the relationship between them, are reflected in the ASTM classification shown in Table 3-1. The term "rank" is used here in a technical sense, as a qualitative measure of the chemical maturity (or carbon content) of the coal, and does not imply inferiority or superiority with respect to end-use. Alberta metallurgical coals are coking coals of low- and medium-volatile bituminous rank. All others are unsuitable for coke manufacture and are therefore classed as thermal coals, suitable for heating and steam raising.

The Board believes that the large reserves of all types of coal represent a most valuable natural resource. The high rank (bituminous) and low rank (subbituminous) coals are, in practice, not always interchangeable, and certain end uses demand coal properties which are sometimes associated with a particular class or sub-class. Having regard to future coal requirements and the environmentally acceptable low sulphur content of Alberta coals, the possibility of selecting coals for particular applications from among the wide range available in the Province could prove of considerable economic importance to Alberta.

3.2 Reserves

Early in 1972 the Board initiated a major continuing program of coal resource appraisal which allowed publication, early in 1973, of the first comprehensive report on coal reserves in Alberta (ERCB 73-31)[1]. A summary from this report, giving the Board's estimates of currently proved remaining in-place and recoverable reserves of coal in each of the three regions, is contained in Table 3-2. These reserves lie in the 53 coal fields and 41 isolated coal deposits outlined in Figure 3-2. The Board anticipates that further exploration will greatly enlarge proved reserves and permit definition of numerous

---

[1] Reserves of coal, Province of Alberta, December 31, 1972.

LIGNITE A*
SUBBITUMINOUS C
SUBBITUMINOUS B*
SUBBITUMINOUS A*
HIGH VOLATILE BITUMINOUS
LOW and MEDIUM VOLATILE BITUMINOUS
8300
9500
10,500
11,500
13,000

LIGNITE A
SUBBITUMINOUS C

FIGURE 3-1

MAP OF

ALBERTA

SHOWING

MAJOR COAL BEARING FORMATIONS

AND

GROSS CALORIFIC VALUES OF COAL

(IN BTU'S / LB)

* MOIST, MINERAL-MATTER-FREE BASIS

** DRY, MINERAL-MATTER-FREE BASIS

LEGEND

PLAINS REGION

SUBBITUMINOUS COAL

Tertiary

PASKAPOO FM

Upper Cretaceous

HORSESHOE CANYON FM/WAPITI GP

51°N SASK R

OLDMAN FM/BELLY RIVER GP/ WAPITI GP

51°N SASK R

FOREMOST FM/BELLY RIVER GP/ WAPITI GP

51°N SASK R

FOOTHILLS REGION

HIGH VOLATILE BITUMINOUS COAL

Upper Cretaceous

ST MARY RIVER FM/EDMONTON FM

50°20'N

BELLY RIVER FM/BRAZEAU FM

MOUNTAIN REGION

LOW AND MEDIUM VOLATILE BITUMINOUS COAL

Upper Jurassic - Lower Cretaceous

KOOTENAY FM/LUSCAR FM or EQUIVALENTS

52°N

0 10 20 30

KILOMETRES

ENERGY RESOURCES CONSERVATION BOARD

CALGARY, ALBERTA

TABLE 3-1

CLASSIFICATION OF COAL
(ASTM Designation D388-66)

Class		Group	Fixed Carbon[1] %		Volatile Matter[1] %		Calorific Value[2] Btu/lb	
			Equal to or Greater Than	Less Than	Greater Than	Equal to or Less Than	Equal to or Greater Than	Less Than
I	Anthracitic	1. Meta-anthracite	98			2		
		2. Anthracite	92	98	2	8		
		3. Semi-anthracite	86	92	8	14		
II	Bituminous	1. Low volatile[3]	78	86	14	22		
		2. Medium volatile[3]	69	78	22	31		
		3. High volatile A		69	31		14,000	
		4. High volatile B					13,000	14,000
		5. High volatile C					10,500	13,000
III	Subbituminous	1. Subbituminous A					10,500	11,500
		2. Subbituminous B					9,500	10,500
		3. Subbituminous C					8,300	9,500
IV	Lignitic	1. Lignite A					6,300	8,300
		2. Lignite B						6,300

[1] dry, mineral-matter-free basis.

[2] moist, mineral-matter-free basis.

[3] Alberta metallurgical coals.

TABLE 3-2

PROVED REMAINING RESERVES OF COAL IN ALBERTA (AT DECEMBER 31, 1972)
(Millions of Tons)

Region	Rank	Recoverable by	In-Place	Recoverable
Plains	subbituminous	Surface Mining	5,107	4,304
		Underground Mining	2,064	1,037
		Beyond Economic Reach	3,001	-
			10,172	5,341
Foothills	bituminous (hvAb[1], hvBb[2], hvCb[3])	Surface Mining	120	102
		Underground Mining	379	124
		Beyond Economic Reach	36	-
			535	226
Mountain	bituminous (lvb[4], mvb[5]) semi-anthracite	Surface Mining	1,364	1,162
		Underground Mining	5,413	2,058
		Beyond Economic Reach	695	-
			7,472	3,220
All Region Totals			18,179	8,787

[1] high volatile A bituminous.

[2] high volatile B bituminous.

[3] high volatile C bituminous.

[4] low volatile bituminous.

[5] medium volatile bituminous.

NORTH POINT COAL CO LTD
13,706
PICARDVILLE COAL CO.(1960) LTD
5,905
EGG LAKE COAL CO LTD
16,853
STAR KEY MINES LTD
21955
MANALTA COAL LTD
CHARLES OSTERTAG
8,152
WABAMUN
569,000 K.W
2,486,734
1,282,136
SUNDANCE
286,000 K.W
WARBURG COAL CO LTD
7,295
DODDS COAL MINING CO LTD
10,557
BURNSTAD COAL LTD
11,850
SITTLER COAL CO LTD
12,716
SISSON HOLDINGS LIMITED
BATTLE RIVER
212,000 K.W
MANALTA COAL LTD
465,279
FORESTBURG COLLIERIES LTD
532,732
CARDINAL RIVER COALS LTD
1,899,740
MOUNTAIN PARK
CROWSNEST LUSCAR
ROCKY MTN. HOUSE
MOUNTAIN CREEK
HR MILNER
140,000KW
MCINTYRE PORCUPINE MINES LIMITED
852,735
75,998 (ABANDONED 73)
1,483,000

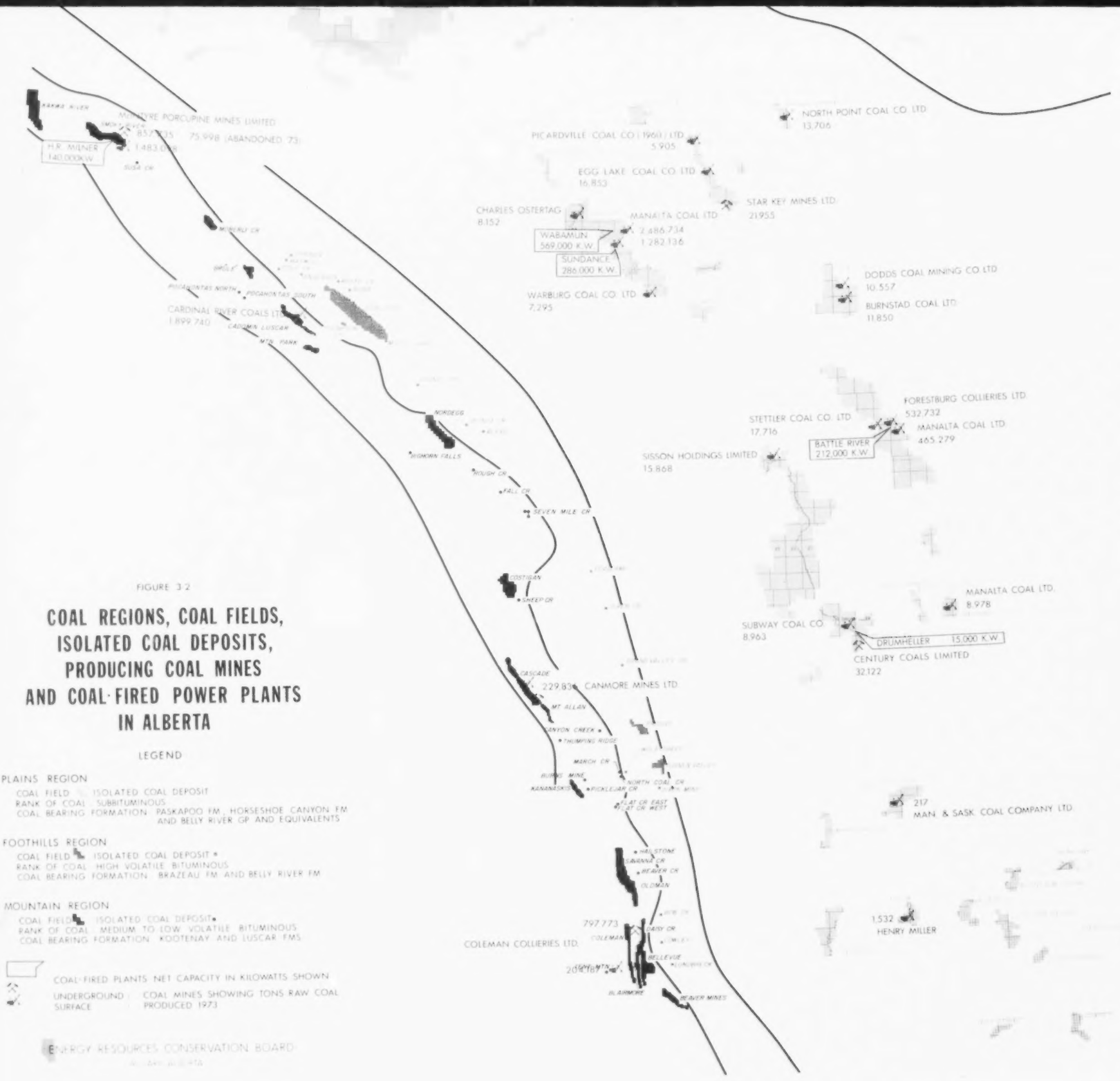


FIGURE 3-2

COAL REGIONS, COAL FIELDS, ISOLATED COAL DEPOSITS, PRODUCING COAL MINES AND COAL-FIRED POWER PLANTS IN ALBERTA

LEGEND

PLAINS REGION
- COAL FIELD
- ISOLATED COAL DEPOSIT
- RANK OF COAL: SUBBITUMINOUS
- COAL BEARING FORMATION: PASKAPOO FM., HORSESHOE CANYON FM. AND BELLY RIVER GP. AND EQUIVALENTS

FOOTHILLS REGION
- COAL FIELD
- ISOLATED COAL DEPOSIT
- RANK OF COAL: HIGH VOLATILE BITUMINOUS
- COAL BEARING FORMATION: BRAZEAU FM. AND BELLY RIVER FM.

MOUNTAIN REGION
- COAL FIELD
- ISOLATED COAL DEPOSIT
- RANK OF COAL: MEDIUM TO LOW VOLATILE BITUMINOUS
- COAL BEARING FORMATION: KOOTENAY AND LUSCAR FMS.

COAL-FIRED PLANTS NET CAPACITY IN KILOWATTS SHOWN

UNDERGROUND / SURFACE: COAL MINES SHOWING TONS RAW COAL PRODUCED 1973

ENERGY RESOURCES CONSERVATION BOARD

additional coal fields. Extensive upward revision of reserves is expected in the Foothills Region in particular, where few detailed exploration programs have been undertaken to date because of little previous demand for high-volatile bituminous coal.

Although somewhat speculative, since geological information is incomplete, ultimate remaining in-place reserves of coal in Alberta are in the order of 100 billion tons of subbituminous coal in the Plains, 10 billion tons of high-volatile bituminous coal in the Foothills, and 30 billion tons of low- and medium-volatile bituminous coal in the Mountain Region. Combined according to end-use, there are 110 billion tons of thermal coal and 30 billion tons of metallurgical coal. These figures represent 52 per cent and 32 per cent of Canada's ultimate thermal and metallurgical coal reserves respectively.

4 THE STRUCTURE OF THE ALBERTA COAL INDUSTRY

4.1 Ownership and Disposition of Coal Rights

With few exceptions, coal rights in the Province are held by the Crown and by owners of freehold mineral rights. Together they control all coal other than rights in Indian Reservations administered by the Department of Indian Affairs and Northern Development of the Government of Canada, in surrendered Indian Reservations where mineral rights have reverted to the Government of Canada, and in national parks controlled by the Government of Canada.[1]

At the discretion of their owners, coal rights may be leased to parties interested in coal exploration and development. The major private holders of coal rights on lands underlain by proved reserves of coal are shown in Figure 4-1, and the distribution of Crown and freehold coal rights on these lands is summarized in Table 4-1. Table 4-2 shows a similar distribution of coal rights on lands underlain by coal-bearing strata.

The Board notes that recently intensified commercial interest in coal, whether early or deferred exploitation is contemplated, has resulted in some leases changing hands fairly frequently, particularly on parcels held as speculative investments.

Of special interest is the acquisition of coal rights by companies who have not been otherwise traditionally associated with the coal industry. Electric utility companies, and more specifically Calgary Power, are beginning to ensure themselves of future economic fuel supplies by acquiring coal rights. In addition, several major oil companies increasingly are becoming energy resource developers, and in some instances are looking to eventual large-scale gasification of coal.

---

[1] CP holds some freehold mineral rights in the national parks.

TABLE 4-1

DISTRIBUTION OF COAL RIGHTS ON LANDS UNDERLAIN BY PROVED RECOVERABLE RESERVES
(Thousands of Acres)

	Freehold	Crown Lease	Crown Open
Plains Region	200	175	155
Foothills and Mountain Regions	20	95	20
All Regions	220	270	175
Percentage of Total	33%	41%	26%

TABLE 4-2

DISTRIBUTION OF COAL RIGHTS ON LANDS UNDERLAIN BY COAL-BEARING STRATA
(Thousands of Acres)

	Freehold	Crown Lease	Crown Open
Plains Region	12,000	770	53,230
Foothills and Mountain Regions	300	1,430	4,270
All Regions	12,300	2,200	58,000
Percentage of Total	17%	3%	80%

FIGURE 4.1

MAJOR COAL RIGHTS HOLDERS IN ALBERTA

ABBREVIATIONS:

CROWN LEASE	CL
FREEHOLD	FH
LEASED FREEHOLD	LF

ENERGY RESOURCES CONSERVATION BOARD
CALGARY ALBERTA

4.1.1 Crown Coal Rights

Control of the mineral resources of the Province was transferred from the Federal Government to the Provincial Government in 1930, and the rights to these minerals are now administered by the Department of Mines and Minerals of Alberta.

At the discretion of the Minister of Mines and Minerals, coal rights held by the Crown may be leased at an annual rental of $1 per acre. A lease conveys the right to explore, develop, and produce. The maximum area of a lease is four sections; and leases are granted for 21 years, with automatic renewal for at least two further 21-year terms. Marketable coal produced from Crown coal leases is subject to a royalty of 10¢ per ton.

4.1.2 Freehold Coal Rights

Freehold mineral rights accrue, in part, from the fact that mineral rights were not excepted in all homestead registrations prior to October 1, 1887. Until 1972 these freehold mineral rights were subject to an annual mineral tax by the Province of 5¢ per acre.

The more extensive commitments, however, came with land grants to certain corporations. In return for the sale of Rupert's Land to the Government of Canada, the Hudson's Bay Company retained title, including mineral rights, to all of section 8 in each township, to three-quarters of section 26 in four out of every five townships, and to all of section 26 in every fifth township. In 1973, these rights, including some 1.6 million acres in Alberta, were transferred to Sieben's Oil and Gas Ltd.[2] in exchange for 35 per cent of Sieben's shares.

---

[2] Siebens, an Alberta company with head office in Calgary, holds interests in oil and gas producing properties.

As an inducement to construction of railways, the Government of Canada similarly made extensive land grants, including the mineral rights thereto, to the Canadian Pacific Railway (hereinafter called CP). CP received some 18.2 million acres in the Prairie Provinces. Much of this was subsequently used as security for bonds issued for construction capital. The Government grants were originally intended to cover alternate sections adjoining the rail line and extending some 24 miles from either side; but because of a clause which allowed CP to substitute a corresponding area elsewhere for any section "not fairly fit for settlement," it accepted only some 5.25 million acres in sections directly adjoining the main line. In Alberta, the remainder was comprised of land which forms the so-called Irrigation Block and the Second Northern Reserve. In all, CP presently owns coal rights on slightly more than 9.64 million acres in Alberta.

In leasing coal rights to others, CP generally follows a policy similar to that of the Government of Alberta with respect to Crown land. The annual lease rental is $1 per acre, and in addition a royalty is levied on coal production. Some 602,377 acres of the most promising coal land have been purchased outright from CP by CanPac Minerals Limited, a company in which Canadian Pacific Investments Ltd. and Cominco Ltd. hold a 60 per cent and 40 per cent interest respectively. In turn, CanPac has leased approximately 62,000 acres to other mining companies.

Freehold land with mineral rights, which was granted to the cities of Calgary and Edmonton for construction of a railway connecting them, is now controlled by Canadian Superior Oil Limited[3]. This area may be relatively unproductive of coal

---

[3] A federally incorporated company with head office in Calgary involved with oil and gas exploration, development and production on an international scale. Member of Canadian Arctic Gas Study Ltd.

as none of the land lies within the coal fields which have been tentatively designated to date by the Board.

4.2 Principal Coal Companies

Over 97 per cent of annual coal production in Alberta is currently derived from mines operated by 6 companies. These, as well as others holding extensive coal rights in the Province who may be expected to commence mining operations within the next few years, are discussed below.

4.2.1 Major Companies

4.2.1.1 The Canmore Mines Limited

Canmore has been active in the Canmore area since 1886 and was latterly controlled by Seattle-based interests. In 1970 it was acquired by the Mining Division of the Dillingham Corporation, an American company with head office in Hawaii. No details concerning this transaction have been released, but it is noted that as now structured, Canmore has an authorized capital of 40,000 shares without nominal or par value and is administered by 6 directors of whom two are Canadian residents.

Canmore presently operates an underground mine and a few short-lived open pits, from which semi-anthracite as well as small volumes of low volatile bituminous coal are extracted. Output of raw coal in 1972 totalled 0.24 million tons. Cleaning in the company's processing facilities, yielded 0.17 million tons of marketable coal which was sold to Japanese consumers. In 1972, Canmore took steps to develop a market for its coal in Central Canada, but to date, no firm contracts for such sales have been announced. Total direct employment by the company in mid-1973 stood at 158 persons maintained at an annual payroll cost of $1.6 million.

Of the 9800 acres to which Canmore holds coal rights, some 3308 acres are leased from the Crown. The remainder is held under direct freehold (see Table 4-3).

4.2.1.2 CanPac Minerals Limited

CanPac is a Canadian-controlled company, owned 60 per cent by Canadian Pacific Investments Ltd. and 40 per cent by Cominco Ltd. Its head office for coal activity is in Calgary and its authorized capital is reported at 10 million dollars.

CanPac is currently associated with the operation of Fording Coal Ltd.'s B.C. mining complex (in which Canadian Pacific Investments Ltd. and Cominco Ltd. also hold 60 and 40 per cent interests respectively). CanPac has also conducted several extensive exploration programs in Alberta. One of these programs has outlined a major metallurgical coal property at Isolation Ridge some 30 miles north of Blairmore.

In mid-1973 CanPac apparently decided to concentrate future work in Alberta on developing thermal rather than metallurgical coal. Options were sold on its Isolation Ridge property to The Granby Mining Company Limited of Vancouver, which is controlled by Zapata Inc. through a 66 per cent interest. The terms of the agreement cover some 31,240 acres of land and allow Granby to exercise its options on the property by 1976.

At present CanPac holds coal rights on 603,074 acres in Alberta. Over 546,000 acres are held as freehold (see Table 4-3).

4.2.1.3 Cardinal River Coals Ltd.

Cardinal River is a joint venture of Luscar Limited and the Consolidation Coal Company of Canada. Each company holds 45 of the 100 shares that comprise Cardinal River's authorized capital, with the remaining 10 shares held by three Canadian residents. The company is administered by an eight-member Board of Directors of which four members are Canadian residents.

Cardinal River operates an open pit mining complex 20 miles southwest of Hinton. Starting in April 1970 1.1 million tons of cleaned metallurgical coal per year are contracted for shipment to Japan under a 15-year agreement. In July 1973 the company

announced the signing of a new 15-year agreement beginning in the summer of 1974, which will raise Cardinal River's total annual sales to Japan to 1.7 million tons. Its current production level is achieved with a work force of 190 men and an annual labour cost, excluding the cost of company benefits, of some $2.4 million as estimated by the Board. As noted in Table 4-3, the firm operates from coal rights of 11,000 acres of Alberta Crown leases registered in the name of Luscar Limited.

4.2.1.4 Coleman Collieries Limited

In 1971, Coleman Collieries, which has operated in the Crowsnest area of Alberta since 1911, was acquired by Northern and Central Gas Corporation Limited, a Canadian-controlled company with headquarters in Toronto. The transaction involved purchase of an 81.8 per cent interest in Coleman Collieries for approximately $15.2 million. Coleman Collieries is a public company which is administered by 8 directors of whom 6 are Canadian residents, and has an authorized capital of $11.05 million. In 1973, it had an effective long-term debt of $13.7 million, of which some 61.5 per cent was payable to the parent company in monthly installments of $81,000 and the full balance due by 1978.

Current activities are centered on underground mining in the vicinity of Vicary Creek, but also involve some open pit operations which are expected to expand in the future. Output in 1972 ran at some 781,000 tons of cleaned metallurgical coal, and is planned to reach 1.1 million tons in 1975. All production is sold to Japan under a 15-year contract. The company now has a work force of some 530 employees which the Board estimates are maintained at an annual payroll cost, excluding benefits, of nearly $6.0 million. Coleman Collieries controls some 59,045 acres of which 22,770 are freehold and the remainder Crown leases (see Table 4-3).

TABLE 4-3

MAJOR COMPANIES WITH
COAL RIGHTS ACREAGES IN ALBERTA

Firm	Crown Leases Acres	Under Direct Freehold Acres	Additional Freeholds Leased Acres
Bralorne	8,320	NIL	NIL
Canmore	3,308	6,013	480
CanPac	56,511	540,371	6,192
Cardinal River	11,000	NIL	NIL
Century	NIL	NIL	4,644
Clearwater	35,000	NIL	NIL
Coleman	36,276[7]	22,770	NIL
Consol	286,946	NIL	13,220[5]
Denison	28,236[4]	NIL	NIL
Granby Mining	20,520	NIL	10,721[4]
Imperial	99,840	NIL	NIL
Luscar	72,249	7,280	NIL
Manalta	96,435	NIL	4,343
McGregor	1,800	NIL	NIL
McIntyre	89,369[1]	NIL	NIL
Meadowlark	17,280	NIL	NIL
Notus	34,560	NIL	NIL
Pacific Petroleum[8]	43,445[2]	NIL	NIL
Scurry-Rainbow	46,615[6]	20,123[3]	NIL
Shell	283,043	NIL	NIL
Sterling-Coal Valley	22,000	NIL	NIL
Woods Petroleum	20,480	NIL	NIL

---

[1] Firm also holds additional working option on 30,491 acres on Crown leases held by M. M. Suska and Scarboro Oil.

[2] Consolidation Coal Company holds 50% working option on 14,340 acres.

[3] Consolidation Coal Company holds 50% working option on 5,781 acres.

[4] Isolation Ridge property optioned from CanPac.

[5] Firm also holds working options on freehold land held by Alberta Industrial Corporations; this land is in trust at present.

[6] Shell also has approximately 20,000 acres through Seaton Jordan Assoc.

[7] Some 132,198 acres are held in equal partnership with other companies.

[8] Pacific Petroleum 35%, BP 35%, Armsco 15%, Union Gas 15%.

4.2.1.5 Consolidation Coal Company of Canada

Consol is a wholly owned subsidiary of Consolidation Coal Company, Pittsburgh, currently the second largest coal producer in the United States. The Canadian company has offices in Red Deer, and holds coal rights to some 300,166 acres in the Foothills and Mountain Regions. Some 132,198 of the 286,946 acres held under leases from the Crown are under shared ownership. In addition, Consol has options (as indicated in Table 4-3) on 13,220 freehold acres.

Aside from its joint venture with Luscar Limited in the Cardinal River operations, Consol has conducted intensive exploration in the Nordegg area where it is expected to propose development of a major open pit mine. Production from this mine may be sold to Japan under a long-term contract now being negotiated. Alternatively, if it proves feasible, this coal may be marketed in Canada.

4.2.1.6 Denison Mines Limited

Denison is a Canadian-controlled company with total capital assets of $121 million in 1973. Of its 14 directors 13 are Canadian residents.

Denison's Coal Division, with offices in Calgary, has completed several exploration projects. It holds promising property near Rock Lake, between Hinton and Grande Cache, where the company is seeking to develop an underground hydraulic mining venture. Output would consist of high grade metallurgical coal which would be available for sale in Japan, the United States, or Europe, depending upon market surveys currently in progress.

In total, Denison has coal rights to some 28,236 acres under Crown leases in Alberta.

4.2.1.7 Luscar Limited

Luscar, with corporate head office in Edmonton, is

a private company controlled by British interests and administered by five directors of whom four are Canadian residents.

In addition to participating with Consol in Cardinal River's coal operations near Hinton, Luscar produces thermal coal in the Plains Region through two subsidiaries, Forestburg Collieries Ltd. and the Manitoba & Saskatchewan Coal Company Ltd. Earlier this year, Luscar also reported acquisition of the Burnstad Coal Company.

Luscar's total coal holdings in Alberta consist of 72,249 acres in Crown leases and 7,280 acres under freehold. In mid-1973, the company's work force in Alberta, excluding head office staff, consisted of 191 employees at Cardinal River and 42 at the Diplomat mine near Forestburg. The combined direct payroll of this staff excluding the cost of benefits, was estimated by the Board at $2.8 million per year.

4.2.1.8 Manalta Coal Ltd.

Manalta, with head offices in Calgary and an authorized capital of $4 million, is a private company in the Mannix Group.

Partly through a subsidiary company, Master Explorations Limited, Manalta has, for many years, carried forward major coal exploration programs in Alberta, and now holds rights in the Plains, Foothills, and Mountain Regions. The most important of the Mountain Region properties lies in the Gregg River area southwest of Hinton, where Manalta is planning to propose development of open pit mining and processing facilities with a productive capacity of some 2 million tons of marketable metallurgical coal per year. In the Plains, Manalta mines coal in the Battle River and Sheerness coal fields; and under a contract with Calgary Power, the company also operates the Whitewood and Highvale mines on Lake Wabamun, which supplied some 3.5 million tons of coal to the Wabamun and Sundance power plants in 1972. Through an affiliate company, Grande Resource Management Ltd., Manalta is

similarly involved in operating open pit workings at Grande Cache on behalf of McIntyre. In 1972 these mines produced nearly 1.2 million tons of marketable metallurgical coal which was sold to Japan.

At present, Manalta holds coal rights to 96,435 acres under Crown leases and to a further 4,343 freehold acres under private leases. In mid-1973, Manalta and Grande Resource Management employed some 380 persons in mining operations in the Plains and Mountain Regions, at an estimated payroll cost excluding employee benefits, of $3.6 million per year.

4.2.1.9 McIntyre Porcupine Limited

McIntyre is a public company in which Superior Oil Limited of the United States is the largest single shareholder, with a 36 per cent interest. Through its affiliate, Canadian Superior Oil Limited, Superior also controls a further 4 per cent interest, and holds a majority on the 11-member board of directors. Six directors are Canadian residents.

With head offices in Toronto, McIntyre reports an authorized capital of $13 million of which about $3.86 million are available for business in Alberta.

Within Alberta, McIntyre works through its Coal Division which was incorporated in 1965 and now operates a mining complex and associated coal processing facilities near Grande Cache. To date, total investment in the coal operation is estimated at $95 million, mostly by extensive debt financing from Canadian banks. As shown in Table 4-3, the company holds the coal rights to some 89,370 acres under Crown leases.

In 1972 output from the company's operations at Grande Cache amounted to 2.0 million tons of prepared coal shipped to Japan under the terms of a 15-year contract. However, in the spring of 1973, McIntyre renegotiated this contract and reduced its commitments to Japanese consumers in order to meet developing demands for Alberta metallurgical coal. Trial shipments of

25,000 tons to U.S. Steel, 185,000 tons to Bethlehem Steel, and between 25,000 and 50,000 tons to Stelco were to be made in 1973.

In mid-1973 McIntyre employed some 470 people at an estimated labour cost of $4.8 million for the year.

4.2.2 Other Companies

Table 4-4 lists other companies with coal interests in Alberta, and outlines their corporate structure. None of these companies, with the exception of Century Coals Limited, is currently producing coal in Alberta.

4.3 Industry Organization

Although the Alberta coal industry is clearly becoming aware of the need for more effective responses to external pressures, its present organization and activities still reflect the dichotomy between thermal and metallurgical coals, and a marked preoccupation with the latter only.

Organizational problems of the kind that plagued the industry in the years prior to its collapse in the early 1950's are undoubtedly much reduced by the fact that coal mining is now almost entirely concentrated in the hands of a relatively few large corporations. Most major operators in the province, as well as a number of important potential producers, have come together in the Coal Association of Canada. Formerly known as the Coal Operators' Association of Western Canada, this organization, which is in some respects still in its formative stages, seeks to represent the industry.

With head offices in Calgary, the Coal Association now has a membership of 16 companies (see Table 4-5), and a full-time staff comprised of a managing director and an executive secretary. Its board of directors is made up of a president, vice-president, and treasurer who are elected by the membership for a 2-year term.

Table 4-4

OTHER COMPANIES WITH COAL INTERESTS IN ALBERTA

COMPANY	NUMBER OF DIRECTORS	RESIDENCE OF DIRECTORS
Bralorne Resources Limited Extraprovincial - April 2, 1931	9	2 Ontario 1 B.C. 1 Quebec 1 U.K. 4 U.S.A.
Century Coals Limited Provincial - October 24, 1946	2	Alberta
Clearwater Coal Ltd. Provincial - October 28, 1971	3	1 Italy 1 France 1 Alberta
Granby Mining Company Limited Extraprovincial - February 8, 1972	9	3 Ontario 1 Alberta 1 B.C. 4 U.S.A.
McGregor Telephone & Power Construction Company Limited Provincial-Inc. May 25, 1925 Amalgamated Dec. 17, 1959	2	Alberta
Meadowlark Farms, Inc. Extraprovincial - October 31, 1969	5	U.S.A.
Notus Exploration Company Extraprovincial - June 16, 1971	9	1 B.C. 8 U.S.A.
Scurry-Rainbow Oil Limited Extraprovincial - February 5, 1954	7	2 Alberta 1 Quebec 4 U.S.A.
Sterling Coal Valley Mining Co. Ltd. Provincial - June 2, 1930	3	Alberta
Woods Petroleum of Canada Ltd. Extraprovincial - August 21, 1969	2	U.S.A.

TABLE 4-5

COAL ASSOCIATION OF CANADA MEMBERSHIP
(November 1973)

COMPANY	ADDRESS	PROVINCE OF OPERATION
Brascan Resources Ltd.	1200 Bow Valley Square 202 - 6 Avenue S.W. Calgary, Alberta	B.C.
Byron Creek Collieries Limited	P.O. Box 270 Blairmore, Alberta	B.C.
The Canmore Mines, Limited	P.O. Box 280 Canmore, Alberta	Alta.
CanPac Minerals Limited	205 - 9 Avenue S.E. Calgary, Alberta	Alta.
Cardinal River Coals Limited	P.O. Box 2570 Hinton, Alberta	Alta.
Coleman Collieries Limited	Coleman, Alberta	Alta.
Northern & Central Gas Corporation Ltd.	P.O. Box 46 Toronto-Dominion Centre Toronto 111, Ontario	Alta.
Crowsnest Industries Limited	P.O. Box 250 Fernie, British Columbia	B.C.
Denison Mines Limited	1660, 540 - 5 Avenue S.W. Calgary, Alberta	Alta., B.C.
Emkay Canada Natural Resources Limited	1304 Hornby Street Vancouver, British Columbia	Alta., B.C.
Fording Coal Limited	P.O. Box 108 Sparwood, British Columbia	B.C.
Kaiser Resources Ltd.	P.O. Box 2000 Sparwood, British Columbia	B.C.
Luscar Ltd.	600 Royal Bank Building Edmonton, Alberta	Alta., Sask.
Manalta Coal Ltd.	P.O. Box 2880 Calgary, Alberta	Alta., B.C.,Sask.
McIntyre Porcupine Mines Limited	P.O. Box 2000 Grande Cache, Alberta	Alta.
Meadowlark Farms Inc. (Amex)	710 Calgary House Calgary, Alberta	Alta.

The constitution of the Coal Association is currently under review, and its full-time staff and board of directors are likely to be enlarged. The Association also expects to establish several committees responsible for special interest areas, such as public affairs, environment management, and the like. However, as now composed, the Coal Association hardly represents all major facets of the Canadian, or for that matter, the Alberta Coal industry. No utility companies and only one of the many oil companies with direct interests in coal are members; and despite the fact that some members operate or hold extensive coal properties in the Plains and Foothills regions, the Association still tends to concentrate its public activities on matters related to production and marketing of metallurgical coal. A unified voice for coal in Alberta is therefore still lacking.

The Board notes, however, that a much broader range of coal interests than is represented by the Coal Association comes together each year in the Canadian Conferences on Coal. These conferences began in 1949 under the aegis of the Dominion Coal Board and,until 1968, were known as the Dominion-Provincial Conferences on Coal. They are now sponsored by the Coal Association, the Department of Energy, Mines and Resources, and the Coal Division of the Canadian Institute of Mining and Metallurgy, and latterly attracted well over 300 delegates. The conference locale rotates among major cities in both Eastern and Western Canada.

Technical matters of concern to the coal industry are also handled by the Coal Division of the Canadian Institute of Mining and Metallurgy, and through publication of papers in that Institute's Bulletin.

4.4 Regulation of the Coal Industry

Administration of legislation respecting regulation of the Alberta coal industry was, from 1949 until 1972, the responsibility

of the Department of Mines and Minerals. The Minerals Division of that department dealt with all matters related to leasing and royalties under The Mines and Minerals Act, and the Mines Division was responsible for safety and other aspects under The Coal Mines Regulation Act.

In 1971 the Government of Alberta decided to consolidate responsibilities for the energy resource management functions of such administration in one administrative body. The enabling legislation to carry out this decision is The Energy Resources Conservation Act which came into force on June 1, 1971. The role of the former Oil and Gas Conservation Board was expanded to that of the Energy Resources Conservation Board. The purposes of this Act are

(a) to provide for the appraisal of the reserves and productive capacity of energy resources and energy in Alberta,

(b) to provide for the appraisal of the requirements for energy resources and energy in Alberta and of markets outside Alberta for Alberta energy resources or energy,

(c) to effect the conservation of, and to prevent the waste of, the energy resources of Alberta,

(d) to control pollution and ensure environment conservation in the exploration for, processing, development, and transportation of energy resources and energy,

(e) to secure the observance of safe and efficient practices in the exploration for, processing, development, and transportation of the energy resources of Alberta,

(f) to provide for the recording and timely and useful dissemination of information regarding the energy resources of Alberta, and

(g) to provide agencies from which the Lieutenant Governor in Council may receive information, advice and recommendations regarding energy resources and energy.

With proclamation of section 52 of The Energy Resources Conservation Act on January 1, 1972, responsibilities for regulating the Alberta coal industry were transferred to the Board, except those relating to leasing and royalties, which remain matters administered by the Department of Mines and Minerals. Accordingly, the function and personnel of the Mines Division of the Department of Mines and Minerals were also transferred.

In assuming these new responsibilities, the Board recognized the inadequacies of The Coal Mines Regulation Act with respect to such matters as conservation and environment management, as well as its obsolescence with respect to certain safety matters, and immediately initiated the development of updated and comprehensive legislation.

The first result of this program was the passage on October 30, 1973, of The Coal Conservation Act. The purposes of this Act are

(a) to provide for the appraisal of Alberta's coal resources,

(b) to provide for appraisals of coal requirements in Alberta and in markets outside Alberta,

(c) to ensure orderly, efficient and economic development of Alberta's coal resources in the public interest,

(d) to effect conservation, and prevent waste, of the coal resources of Alberta,

(e) to assist the Government to control pollution and ensure environment conservation in the development of coal resources of Alberta,

(f) to ensure the observance of safe and efficient practices in the exploration for, mining, storing, processing, and transporting coal, and

(g) to provide for the recording, and for the timely and useful dissemination, of data and information relating to exploration for coal and to the occurrence, reserves, quality, production, transportation, processing and use of coal in Alberta.

Regulations under The Coal Conservation Act are expected to be established early in 1974.

In addition, a new Coal Mines Safety Act, designed to replace The Coal Mines Regulation Act, has been recommended to the Government for consideration by the Legislature during the 1974 spring session. The purposes of this Act will be

(a) to secure the observance of safe practices in the exploration for, mining, storage, processing, and transporting of coal,

(b) to provide for and ensure the safety and preservation of health of all persons employed at or otherwise authorized to enter a mine site and its various connected facilities,

(c) to establish the qualifications for competent persons in and about mine sites, and

(d) to secure the provision and use of safe and proper equipment and installations in and about mine sites.

Proposed regulations under this Act have been submitted for review by companies, labour organizations, and government agencies with direct interests in these matters.

Early in 1972 the Board also initiated a major continuing program of appraisal of Alberta's coal resources which resulted in the publication in April 1973 of a first comprehensive report on the Province's proved remaining coal reserves.

Because many activities related to coal exploration, mining, and processing are also subject to other statutes, procedures currently are being developed in accordance with stated government policy, which will enable the Board to operate as the

principal interface between the coal industry and other concerned government departments. Environmental matters are of particular concern, and two Government departments, along with the Board, administer regulations which influence the operations of the coal industry. The Department of the Environment, which assumes overall responsibility for the environment, administers The Clean Air Act and The Clean Water Act, as well as The Land Surface Conservation and Reclamation Act. The Department of Lands and Forests becomes involved in environmental regulation through administration of the Mineral Surface Lease Regulations. The Board shares some responsibility with these two Government departments for environmental protection. The Board expects to assume further responsibility through regulations being developed under The Land Surface Conservation and Reclamation Act, which will establish a committee review and referral system for proposals respecting the development of coal mining operations.

Regulation of the coal industry is also influenced by the Environmental Conservation Authority, whose recommendations on land use and environment management are considered when appropriate regulations are being developed. The Authority conducted public hearings in late 1971 and early 1972 on "The Impact on the Environment of Surface Mining in Alberta", and on "Land Use and Resource Development in the Eastern Slopes" in mid-1973. Recommendations resulting from the latter hearings are expected to bear directly on future coal development in the Foothills and Mountain Regions.

5 CURRENT PRODUCTION, DISPOSITION AND VALUE, PRICING AND REVENUE

Detailed statistical information about Alberta coal production, disposition and value is regularly published in the Board's "Monthly Statistics - Alberta Coal Industry"; and annual statistics, together with 10-year historical data, are reported in the Board's "Cumulative Annual Statistics - Alberta Coal Industry".

In these and other Board reports, "raw coal" refers to coal as it is extracted from the mine; and "marketable coal" refers to coal which has been cleaned or otherwise processed to meet particular market requirements. In the case of Plains subbituminous coals, marketable and raw coal are generally synonymous since little or no preparation (other than sizing for domestic use) is needed to meet market demands. However, specifications for metallurgical coal generally make it necessary to clean raw bituminous coal in order to reduce its ash content to 6 to 9 per cent and this typically results in the rejection of 25 to 32 per cent of the raw coal feed as discard.

In all cases, value of coal sales refers to the value f.o.b. mine site.

5.1 Production

As shown in Figure 2-7, production of raw coal in Alberta rose from 2.29 million tons in 1963 to a new high of 10.54 million tons in 1972. In 1971, production totalled 8.9 million tons and surpassed the previous record, set in 1946, by some 100,000 tons. Preliminary data for 1973 indicate a production level similar to that of 1972.

Of the total 1972 output, thermal coal from the Plains Region accounted for 4.91 million tons. Approximately 4.7 million tons, or 96 per cent of this volume, came from four large surface mines operated immediately north and south of Lake

Wabamun, and in the Forestburg-Halkirk area. The remainder was furnished by 13 smaller Plains surface mines and two underground mines, one near St. Albert and the other near Drumheller. (The latter contributed approximately 50,000 tons.)

The four mine sites in the Mountain Region, at Grande Cache, Luscar, Canmore and Coleman produced 4.1 million tons of marketable metallurgical coal from 5.63 million tons of raw coal. Open pit and underground workings contributed respectively 55 and 45 per cent to this output.

5.2 Disposition and Value

As in the immediately preceding years, almost all thermal coal produced in 1972 was used in Alberta for generation of electric energy in Calgary Power's Wabamun and Sundance plants and in Alberta Power's Battle River plant. Only 250,000 tons, or 5 per cent of production, at a heating value of 16 million Btu's per short ton, was used for space heating and sundry other purposes, and only 187,000 tons was disposed of in extra-provincial markets. As shown in Figure 5-1, coal demand by electric utilities increased over 1971 demand by some 486,000 tons, or 11 per cent, and reflects both the steadily rising consumption of electric energy in Alberta and the growing importance of coal as an energy resource.

The value of thermal coal marketed in 1972 was $10.2 million.

Raw metallurgical coal was sent to coal processing plants operated in conjunction with the mines, and yielded some 3.92 million tons of marketable coal with ash contents in the range of 6 to 9 per cent. Processing rejects totalled approximately 1.5 million tons of which 153,000 tons, representing a so-called middlings fraction suitable for generation of electric energy, was stockpiled by McIntyre and sold to Alberta Power for use in its H.R. Milner power plant near Grande Cache.

Sales of marketable metallurgical coal to Japanese

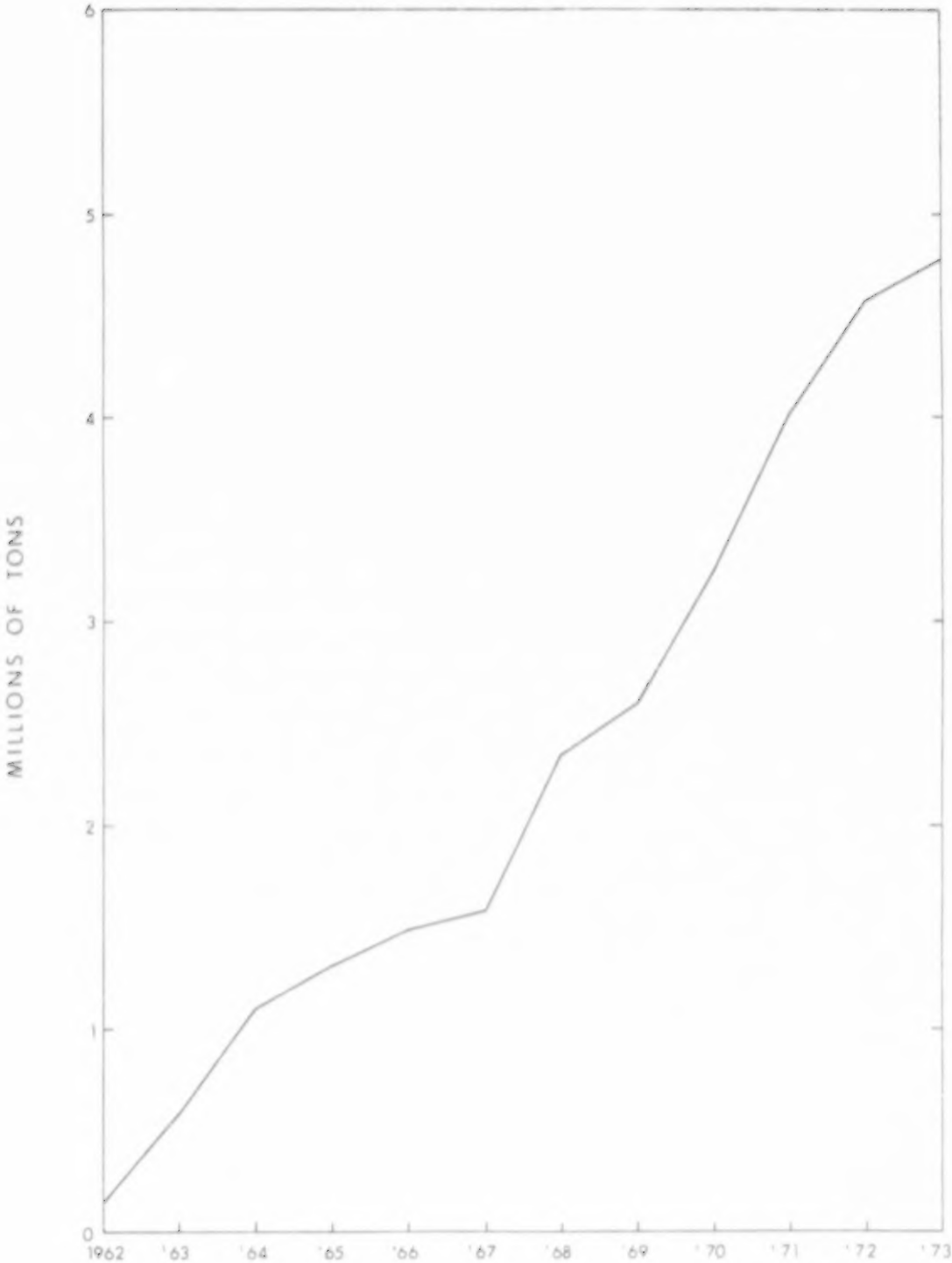


FIGURE 5-1 ANNUAL COAL CONSUMPTION FOR ELECTRIC ENERGY GENERATION IN ALBERTA 1962 - 1973

consumers in 1972 totalled 3.62 million tons valued at some $38 million. Some upward revision of contract prices in 1973 is expected to result in a 1973 sales value of over $40 million on a volume similar to that marketed in 1972.

Table 5-1 shows the companies to whom custody of marketable metallurgical coal was transferred at port facilities in Vancouver, and also lists the major consumers of this coal. The Board notes that while output from mines at Canmore is generally designated as metallurgical coal, this coal is used in Japan for gas-making rather than manufacture of metallurgical coke.

5.3 Pricing

5.3.1 Thermal Coal for Generation of Electric Energy

Since commencement of large scale surface mining in the Plains Region in 1962, annual production at mines serving thermal power plants in Alberta has steadily risen, and allowed fixed costs, particularly charges relating to amortization, maintenance, and replacement of mining equipment, to be spread over progessively larger coal tonnages. As a result, prices of thermal coal for generation of electric energy have remained relatively stable over the past decade, in spite of escalating wage rates.

Table 5-2 shows average annual prices per million Btu delivered at power plants, as well as total production of coal for power plant use and total labour costs incurred in connection with this production.

Actual prices in 1972 were 12.5 cents per million Btu to Alberta Power's Battle River Plant, and 11.4 cents per million Btu to Calgary Power's Sundance and Wabamun power plants. The slightly lower prices to Calgary Power are partly due to that company's ownership of the coal in the Whitewood and Highvale mines, and also to a somewhat different method of cost accounting.

5.3.2 Thermal Coal for Residential-Commercial Uses

The relatively small tonnages of thermal coal produced for

TABLE 5-1

IMPORTERS AND CONSUMERS OF ALBERTA METALLURGICAL COAL

Importers	Consumers
Mitsubishi Corp.	Nippon Steel
Marubeni	Nippon Kokan
Mitsui & Co.	Kawasaki Steel
Toyo Menka	Sumitomo Metal
C. Itoh & Co.	Kobe Steel
Sumitomo Shoji	Nisshin Steel
Nissho-Iwai	Nakayama Steel
Kawatetsu Trad.	Osaka Iron
	Mitsubishi Chemical
	Tokyo Gas
	Toho Gas

TABLE 5-2

THERMAL COAL FOR GENERATION OF ELECTRIC ENERGY IN ALBERTA

Year	Total Production For Use in Power Plants Tons	Average Annual Price ¢/MM Btu	Average Annual Price $/ton*	Total Labour Cost $
1963	1,654,293	9.96	1.59	1,850,000
1964	2,104,912	8.33	1.33	1,800,000
1965	2,554,752	7.78	1.24	2,070,000
1966	2,587,685	7.49	1.20	2,070,000
1967	2,663,723	7.50	1.20	1,990,000
1968	2,976,634	7.31	1.16	1,860,000
1969	3,194,952	7.96	1.27	1,900,000
1970	3,920,206	7.74	1.23	2,110,000
1971	4,425,731	8.21	1.31	2,470,000
1972	4,911,939	11.65	1.86	2,720,000

* assumed at 16,000,000 Btu/ton.

residential-commercial markets command very much higher prices than thermal coal used for generation of electric energy, because conventional coal-fired space heating equipment demands coal in specified size ranges, and because production of such coal often requires selective mining as well as careful screening at the mine. Typical 1973 prices for premium coal sizes are shown in Table 5-3.

In part, these prices reflect the domestic mines' inability to dispose of so-called "fine" coal, that is coal in sizes below those required by domestic consumers. At Drumheller, a stockpile existed until recently of some 30,000 tons of this fine coal which had been offered for sale at $1.20 per ton f.o.b. mine, without finding a buyer.[1]

5.3.3 Metallurgical Coal[2]

Prices of marketable metallurgical coal in 1972 varied from about $10 to $14 per ton f.o.b. rail cars. Transportation and handling costs raised these prices by approximately $5.50 per ton at the docks in Vancouver; and ocean freight added a further $4.00 per ton to result in c.i.f. Japan prices in the range $19.50 to $23.50 per ton.[3] Contract revisions negotiated in 1973 increased the average c.i.f. Japan price by some $4.00.

For comparison, it is noted that 1972 c.i.f. Japan prices for similar coal from the United States and from Australia averaged $27 and $18 respectively.

---

[1] Although suitable for generation of electric energy, the costs of moving this and other relatively small volumes to power plants appears to make them uneconomic. The Board has been advised that the Drumheller stockpile has now been sold for use in a local power plant which was reactivated to meet an interim energy requirement in the area.

[2] Although prices for metallurgical coal sold to Japan always refer to long tons (2240 lbs.), they have here, in the interests of greater consistency, all been recalculated for short tons (2000 lbs.).

[3] Production cost, insurance, and freight (c.i.f.).

TABLE 5-3

1973 PRICES FOR SIZED DOMESTIC COAL

Size Designation[1]	Screen Size	Price Range[2] ($/ton)	Average Price ($/ton)
Lump	+ 4 1/2"	4.50 - 10.00	7.00
Egg	2" x 4 1/2"	5.00 - 11.50	6.50
Nut	1 1/8" x 2"	5.30 - 7.50	6.00
Stoker	5/8" x 1 1/8"	5.00 - 8.00	6.00
Slack	0" x 5/8"	1.50 - 5.00	3.50

Oil Treatment (to suppress dustiness) - $0.35 - $0.50 per ton

---

[1] As established by regulations under The Coal Sales Act.

[2] The wide range of prices in each size reflects variation in coal quality (notably heat content and ash) as well as demand in different parts of the province.

The prices now received by Alberta producers were in all cases renegotiated with Japanese purchasers some time after the signing of their respective initial long-term contracts. The increases reflect some escalation of the commodity price of metallurgical coal as well as rising transportation costs, but are also indicative of the extent to which producers previously tended to under-estimate production costs and, consequently, under-price their product. Average price movements of coal from Alberta producers since their respective initial contract years are summarized in Table 5-4.

TABLE 5-4

PRICE MOVEMENTS OF PREPARED ALBERTA METALLURGICAL COAL
(All prices are for short tons f.o.b. Vancouver)

	Initial Price* ($/ton)	1973 Price ($/ton)
The Canmore Mines, Limited	11.34 (1968)	15.73
Cardinal River Coals Ltd.	10.76 (1970)	16.71
Coleman Collieries Ltd.	9.87 (1967)	17.98
McIntyre Porcupine Mines Limited	12.41 (1970)	19.42

* The Initial Price refers to the price in force at the time the contract became effective. The year in which it did so is shown in parentheses.

6 TRENDS AND TECHNICAL DEVELOPMENTS BEARING ON DEMAND, SUPPLY AND PRICING

Alberta's coal is neither a unique nor an especially highly regarded energy resource even though its low sulphur content (0.2 to 0.7 per cent) tends, for environmental reasons, to give it some marketing advantages at the moment. As a fuel for space heating or steam raising, it is less attractive than oil or gas which offer advantages through greater ease of handling and cleanliness. Even in the iron and steel industry where coal is often still viewed as an essential raw material and Alberta metallurgical coal is presumed to have large potential markets, coal requirements are frequently reduced by recourse to gas, oil or petroleum coke.

In general, major outlets for Alberta coal can therefore be expected to develop only where other sources of energy are in short supply or where coal is so favourably priced relative to its competitors as to dictate its use on economic grounds.

6.1 Factors Determining Coal Demand

6.1.1 Inter-Fuel Competition

In residential, commercial, and industrial fuel markets, choices between alternative energy resources tend to be made on the basis of user convenience rather than price and, consequently, little coal demand is foreseen over the forecast period.

Within Alberta, the full impact of rising gas prices will be substantially eased by the government's rebating policies, and residential, commercial and industrial consumers are expected to continue their present heavy reliance on natural gas. Elsewhere in Canada, there are not likely to be compelling grounds for changing historical patterns of fuel consumption because the effective price differential between coal and other fuels will tend to be reduced by high coal transportation costs.

With the possible exception of certain heavy industrial

operations (such as cement manufacture), in which it may be found desirable to turn to coal, the use of thermal coal over the next decade is expected to be governed by the economics of generating electric energy from coal or alternative fuels.

As shown in the Board's report on "Choices Among Energy Resources for Generation of Electric Energy in Alberta" (ERCB 73-C, April 1973), projected cost differentials between coal and gas in Alberta are sufficiently great to require the use of coal in future generating plants. At the time that report was released, field prices of natural gas were expected to rise to between 44 and 64 cents per million Btu by 1980 and into the range of 52 to 82 cents per million Btu by 1985. Events since then lead the Board to anticipate further price escalation. On the other hand, prices of surface-mined Plains coals were estimated to range between 21 cents and 25 cents per million Btu in those years, and these projections are still considered valid. Annual requirements of thermal coal for generation of electric energy in Alberta were accordingly projected in ERCB Report 73-C to rise progressively, reaching some 11 million tons in 1980 and 19 million tons in 1985.

The Board recognizes that restrictions on the use of natural gas in future base-load thermal generating plants will effectively eliminate gas as a competitive boiler fuel in the Province; and in the long run, the limited availability of gas, its price, and its increasingly apparent premium value as a residential-commerical fuel should also severely limit its use for base-load electric energy generation elsewhere in North America.

Nevertheless, having regard to the presently proved recoverable coal reserves, to the numerous sites potentially available for new thermal power plants, and to the lack of opportunities for substantial local marketing of coal, the Board believes that for at least the next decade, prices of thermal coal in Alberta will tend to reflect costs of production rather than competition among consumers. Eventually, as the best sites

for mine-mouth generating facilities are developed and the most easily accessible coal reserves thus become committed, this situation could change. Until then, however, not even substantial entry of Alberta thermal coal into Ontario or other extraprovincial markets is likely to have a significant effect on pricing within Alberta. The Board notes that competition by other means of electric energy generation, specifically nuclear generation, and the high costs of transporting Alberta coal to distant markets are constraints on upward movement of coal prices at the mine. As the commodity value of coal in extraprovincial markets rises, competition from Foothills bituminous thermal coal, now potentially available at some 30 cents per million Btu, is likely to make itself felt. This coal, if deliverable at acceptable costs, would be preferred over Plains coal because of its higher heat content.

The Board emphasizes that these considerations apply equally if demand for Alberta thermal coal in overseas markets (Japan, Western Europe and South America) develops in the wake of the current energy crisis or if substantial tonnages of coal will be required for coal gasification in the Province, as is expected by the mid-1980's. In the former case, transportation costs will tend to hold mine prices near levels reflecting costs of production; and in the latter, conversion costs and the costs of nuclear energy are likely to prevent undue increases in coal prices.

6.1.2 Transportation

6.1.2.1 Rail

The efficiency of any transportation system is ultimately reflected in unit costs. With respect to coal, these are conveniently expressed in mills per ton mile or cents per million Btu per 100 miles.

Unit train operations which now move metallurgical coal from Alberta to the West Coast, and the dock installations which

are there used for transfer of the coal to ocean freighters (see Sec. 8.4), have generally proved satisfactory. The only real problem appears to have been created by generation of airborne coal dusts during transit. Running between 1 and 2 per cent of the coal volumes hauled to Vancouver, these dusts represent significant economic losses to producers and, more important, also have unacceptable environmental effects. Producers are therefore now field-testing several coal loading procedures which promise to reduce these dust losses. One such method, which is already claimed to have given good results, involves topping the rail cars with relatively coarse coal; and other methods entail spraying the top coal in fully loaded cars with oils.

The Board assumes that expanded transportation facilities capable of handling greater quantities of coal could be provided without serious difficulty. If so, little would stand in the way of gaining entry to several potential overseas markets or to Eastern Canadian markets that could logically be supplied via ocean vessels (see Sec. 6.1.2.2).

The average cost of moving coal from Alberta mines to Vancouver is $4.70 per ton (excluding port handling charges) or about 6.7 mills per ton mile and this is expected to escalate at a rate in excess of 5 per cent annually. Having regard to prevailing and projected world prices for high grade metallurgical coal, to the effects of recent currency changes, and to the new prices which Alberta producers have secured through contract renegotiations with Japanese purchasers, the Board believes that the operators have been able to absorb freight cost escalation to date without compromising their position in established markets. It does recognize, however, that further increases could counter efforts to develop new outlets for Alberta metallurgical coal. If applied to other routes, increased transportation costs could, in particular,

jeopardize attempts to secure sales in Central Canada, the United States, and Western Europe, where competition from other sources is intense.

The economics of transportation are even more critically important for the movement of Alberta thermal coal to Ontario where interest is being expressed in substantial volumes for electric energy generation. At prevailing fuel prices Plains coal priced at $2.40 per ton or 15 cents per million Btu would only be marginally competitive even if moved at $6.40 per ton or approximately 3 mills per ton mile. (For high-volatile bituminous coal from the Foothills region, costing $6.90 or 30 cents per million Btu, the corresponding charges would have to be about $5.75 per ton or 2.6 mills per ton mile).

The Board notes that an independent study commissioned by the Government of Ontario and completed late in 1973 suggests that transportation costs for moving Western coal to Ontario should be considerably less than the charges which Canadian National and Canadian Pacific currently consider necessary for a viable operation. The study, however, did not appear to include expenditures likely to be incurred in coping with certain technical problems which low rank coals tend to create. In particular, transport of subbituminous coal in conventional open cars over long distances can pose serious fire hazards through autogenous heating.

These difficulties, which would not arise if high-volatile bituminous coals rather than subbituminous coal from the Plains were to be rail-hauled, are by no means insurmountable. Autogenous heating (as well as generation of airborne dusts) could be largely prevented by using closed rail cars and by adopting established safe stockpiling methods. Should further development of a novel coal processing technique invented at the Research Council of Alberta prove successful, it may also become possible to transport safely treated subbituminous coal

in open cars without fire risks. However, the additional costs associated with safe rail transport and storage remain to be determined, and they may be high enough to turn attention from rail movement to pipe line transmission of coal.

6.1.2.2 Ocean Shipping

Ocean shipping is generally not a constraint in intercontinental coal transportation systems, and, assuming continuing availability of ships, should not become one in the future. Shipping rates are very sensitive to international demand for ships, to vessel size, to the magnitude of the contract, and to the frequency of use. These factors are reflected in the fluctuation of shipping costs to Japan which are said to presently average some $4.00 per ton for large long-term coal shipment contracts but could be as high as $10.00 per ton for spot shipments.

To service European markets from the Canadian West Coast, the limitations on vessel size imposed by the Panama Canal could be evaded by using larger freighters following the route around Cape Horn. Information on the likely shipping cost to European and South American markets is lacking, but recent contracts for sizeable bulk shipments from the lower U.S. West Coast to Europe have been reported at $10.50 per ton, while a recent bulk shipment from Vancouver to Chile was quoted at $12.50 per ton. Shipping rates to South America on long term contracts for large volumes would likely be similar to those to Japan.

6.1.3 Pipe Line Transport of Coal

Technology for pipe line transmission of granular solids in slurry form, that is, as suspensions in a suitable carrier liquid, is well advanced and already fairly widely used to transport bulk minerals and metal concentrates. An example is the 273-mile long, 18-inch diameter Black Mesa line which is currently the world's longest solids pipe line. This facility

commenced operations in 1971 and can move up to 5.0 million tons of coal per year as a 48 per cent by weight coal-in-water slurry from the Navajo-Hopi Indian Reserve near Kayenta, Arizona, to the Mohave power plant, 90 miles south of Las Vegas.

Where rail facilities exist suitable for unit train operations, long distance pipe line transmission of water slurries appears to offer few economic advantages. In Canada it is generally thought that water slurries will only command interest in connection with certain mining schemes such as the movement of hydraulically mined coal to a near-by preparation plant or, under certain conditions, in remote frontier areas. However, having regard to the location of energy resources and to the demand for different fossil fuels in Canada, there are prospects, in the foreseeable future, for the transport of coal-oil slurries. A coal-oil slurry would provide for a 100 per cent pay-load in the line and would also allow fluctuations in the demand for coal or oil to be accommodated without significantly affecting the overall economics of the pipe line operation.

Coal-oil slurry pipe lining was studied in the laboratories of the Research Council of Alberta during the early 1960's, and the Council holds a Canadian patent on the process. Serious industrial interest in this concept, however, has developed only recently, principally as a result of the escalation of gas prices, of restrictions on the sulphur contents of boiler fuels, and of concomitant fuel supply problems in the Ontario utility fuel market. Of particular importance in this connection is the proposal by Interprovincial Pipe Line Company, announced early in 1973, to investigate the use of its facilities for transmitting 10 to 15 million tons of Alberta subbituminous coal per year in the form of oil slurries to Southern Ontario. The scheme proposes partial cleaning and drying of subbituminous coal at its point of origin before entraining it in oil,

separating the two fuels at the delivery terminus, and sending most of the oil to refineries. A concentrated slurry, containing 15 to 20 per cent by weight residual oil, would be sold to Ontario Hydro for use in its power plants.

While technical details remain to be worked out and a considerable volume of development work may have to be undertaken, Ontario Hydro has shown interest in the proposal. Assuming the coal at source to cost 15 cents per million Btu in Alberta, the Board estimates that thermal coal could be delivered in Ontario at 60 to 65 cents per million Btu. The Board believes that a price in this range will prove quite competitive with environmentally acceptable fuels from other sources within the next 3 to 4 years. It also notes that the scheme would utilize low rank Plains coal (with a heat content of about 8,000 Btu per pound) without obliging Ontario Hydro, whose power plants were designed to burn imported U.S. bituminous coal with heat contents in the range of 12,000 to 12,500 Btu per pound, to significantly derate its boilers.

Interprovincial has indicated its hopes of beginning to move coal-oil slurries in 1976 or 1977; and whenever this happens, the same facilities could also economically transport Alberta metallurgical coal to Ontario steel makers, who have indicated some interest in switching from their current U.S. suppliers to Canadian sources.

With respect to Interprovincial's proposal, the Board believes that consideration ought to be given to substituting some underground subbituminous coal from the Drumheller Field (with 9,600 Btu per pound) for part of the Plains strip-mined coal which Interprovincial is currently considering moving to Ontario. The somewhat higher cost of the coal at its point of origin (about 30 cents per million Btu) would be offset by significantly lower ash and moisture contents and by the higher heat content. For Alberta, the advantage would lie

mainly in the conservation of more cheaply mineable and less easily transported coal for use within the Province or in less distant extraprovincial markets.

6.1.4 Coal Conversion Technology

Basic technology for converting coal into organic chemicals, "synthetic" liquid fuels and "power" gas has been available since the early 1920's and was fairly widely used in Europe immediately before and during World War II. Most of the operations were abandoned as cheaper conventional oil and natural gas became available; but recently, in response to developing shortages and rapidly escalating energy prices in the United States, coal liquefaction and gasification technologies have again begun to attract interest.

6.1.4.1 Coal Liquefaction

Conversion of coal into liquid fuels can be accomplished directly by Bergius hydrogenation (or a modification thereof) or indirectly, by Fischer-Tropsch hydrogenation.

In the former case, pulverized coal or a solvent extract of coal (sometimes mixed with oil to facilitate handling) is catalytically treated with hydrogen at elevated temperatures and pressures. In most cases, a multi-stage process, with appropriate internal recycling, is used to maximize yields of low and medium boiling hydrocarbons. Conversion efficiencies and the composition of the product liquid fuels mixture depend on operating conditions and the choice of catalysts.

In Fischer-Tropsch hydrogenation, the coal is transformed into a synthesis gas, mainly a mixture of carbon monoxide and hydrogen which is then reacted over catalysts at elevated pressures and temperatures to produce methane and higher boiling hydrocarbons. As in Bergius hydrogenation, the yield and composition of the products are determined by the choice of catalyst and the operating conditions.

Bergius hydrogenation is currently only used in some European countries to convert tars and heavy oils into marketable liquid fuels; but Fischer-Tropsch hydrogenation of coal is employed in at least one major chemical installation, the SASOL plant near Johannesburg, South Africa.

Improved direct coal liquefaction procedures, in some instances involving radical departures from classical methods, are now under close study in several U.S. laboratories. Advanced coal liquefaction technology is expected to meet a significant share of the U.S. oil demand by the mid-1980's, but is unlikely to command much interest in Alberta where the oil sands offer more economical oil supplies.

6.1.4.2 Coal Gasification

Conversion of coal into gaseous fuels involves, in essence, reacting coal with steam at temperatures between 1600 and 1900° F and pressures to approximately 1100 psi. This reaction delivers a crude synthesis gas which will have a heating value between 160 and 360 Btu per scf, depending upon process conditions, and after cleaning, can be used as a utility fuel (particularly for generation of electric energy in conventional or combined cycle power plants). Alternatively, the synthesis gas can be methanated and thereby converted into a high-Btu pipe line gas (SNG) indistinguishable from natural gas, or used as a petrochemical feedstock (see Fischer-Tropsch hydrogenation above).

Figure 6-1 indicates the stages which comprise coal gasification.

The current status of coal gasification technology has been reviewed in a recent Research Council of Alberta publication (Information Series 64) which directed particular attention to the several "advanced" coal gasification processes now under development in the United States.

The first two commercial coal gasification plants designed

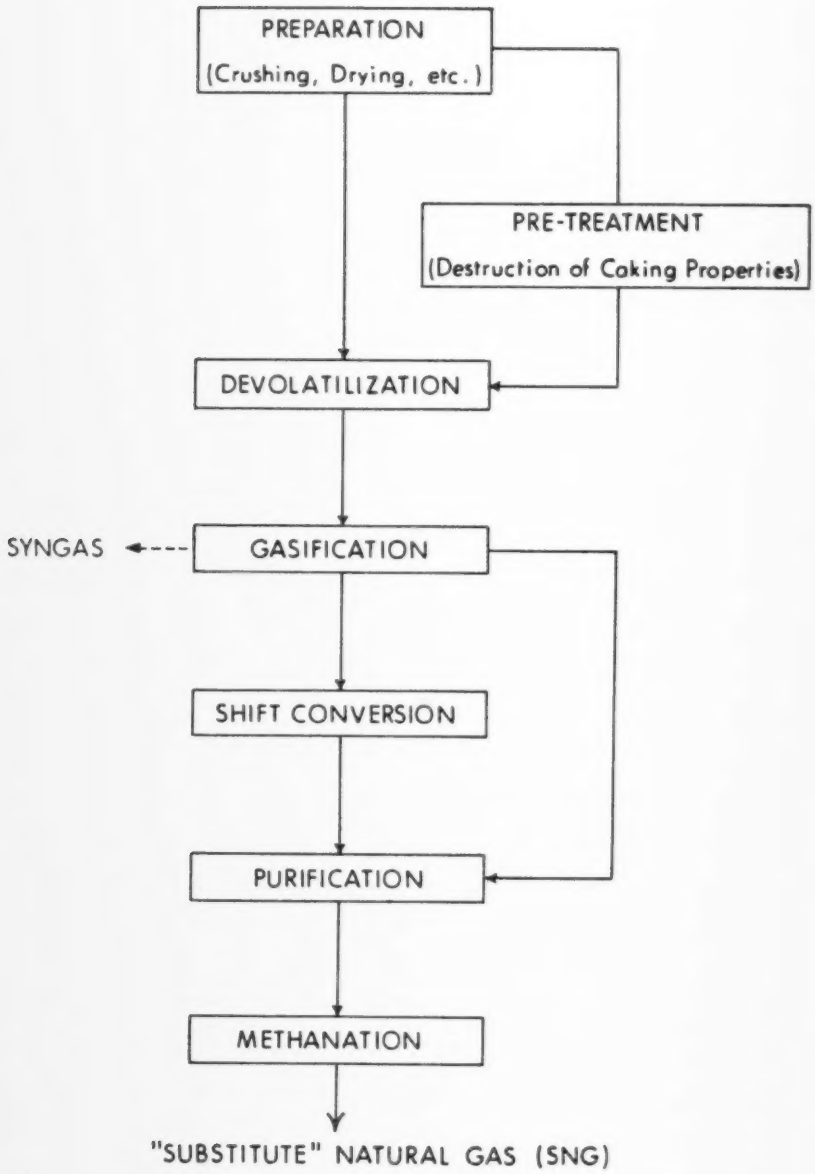


FIGURE 6-1 COAL GASIFICATION

to furnish fully methanated SNG are both located on extensive strip coal resources in New Mexico. They are scheduled to come on stream in 1977, and should provide gas at the plant gate price of about $1.10 to $1.15 per Mcf. Second-generation gasification plants, based on one or more of the half-dozen processes now in the pilot plant stage in the U.S., are projected to begin operating in the early 1980's and to allow manufacture of low-Btu gas or SNG at significantly lower costs. Current est'mates put the price of low-Btu gas at the site of a second-generation plant near 50 cents per million Btu and that of SNG in the range of 75 to 90 cents per million Btu.

A facility making 250 MMcf/d would require some 4.0 million tons of bituminous coal or 5.5 million tons of subbituminous coal per year, excluding the coal requirements for steam raising for the process. If the steam raising demand is included the total gasification process would require some 8 million tons of subbituminous coal per year.

6.2 Factors Determining Coal Supply

Present proved recoverable reserves of coal in Alberta, which are certain to be enlarged through further exploration, are sufficiently large to accommodate foreseeable demand for many years. Therefore, supply will not be limited by available resources but will depend mainly on mining technology, availability of labour, and government policies respecting use of Crown lands.

6.2.1 Mining Technology

In the Plains Region, surface mining methods have now reached a stage of technical development where further improvements in coal production over the next decade will depend more on economies of scale than on changes in mining technology. There is consensus that introduction of larger, more versatile stripping equipment, when justified by demand, could not only provide

access to important deposits of coal that are presently considered to lie beyond economic stripping depth, but also minimize escalation of coal prices over the forecast period and beyond (see Sec. 6.3).

Similar economies of scale are also expected to improve production and relative costs of metallurgical coal from open pit mines in the Mountain Region and, under certain circumstances, to make high-volatile bituminous (thermal) coal from the Foothills competitive with Plains subbituminous coal. However, in both these regions, the Board anticipates some improvements in mining technology, in particular, introduction of more efficient means for extracting coal from steeply pitching, thick seams.

The Board further believes that coal mining in the Mountain and Foothills Regions will gradually place greater emphasis on underground operations which would avoid difficult land surface reclamation and related problems in tectonically disturbed, elevated terrain. It notes, in fact, that most of the coal resources in the Mountain region are not recoverable by surface mining methods. Serious attention is already being given to underground hydraulic mining where geological conditions allow it. It would increase productivity as well as recovery of in-place reserves, and would virtually eliminate adverse environmental impact. Where hydraulic mining is impracticable, the Board assumes that underground mining, for the most part, would involve adaptations of conventional room-and-pillar methods; but introduction of more suitable machinery than has so far been tested in Western Canada may, in some instances, also permit longwall mining.

Should demand for Alberta thermal coal exceed the projected requirements of Alberta and certain extraprovincial utility companies (see Sec. 7.1 and 7.2), underground mining may also be revived in the Plains Region. In some areas, such as Drumheller, high volume underground production could furnish coal at per million Btu prices similar to or somewhat below those applicable

to surface mined Foothills bituminous coal.

6.2.2 Mine Labour

Despite sustained recruiting drives, the Alberta coal industry still encounters considerable difficulties in attracting and retaining qualified manpower. Almost all companies report shortages of skilled trades, notably mine electricians and mine mechanics. Operators of underground mines (at Grande Cache, Canmore and Coleman) also find it difficult to secure experienced miners. In addition, manpower turnover due to voluntary termination of employment by employees tends to be high, running at an average rate of 7 to 8 per cent of the labour force per month in surface mines and 5 to 6 per cent per month in individual underground operations. Significantly, much of this turnover is caused by a tendency of miners to migrate from one company to another rather than by intentions to leave the coal industry altogether.[1]

Efforts to relieve manpower shortages by relocation of mine personnel from the Maritime provinces and by recruiting drives overseas have only met with limited success. The industry has, therefore, developed or participated in several manpower training programs with assistance from federal and provincial government agencies.

The most direct course of action has been pursued by McIntyre, which, aided by Alberta's Division of Vocational Education, has conducted a series of 8-week pre-employment courses for men seeking work as miners. The cost of this program, approximately $920 per man, was absorbed by the Government of Alberta, but the company provided instructors and all necessary facilities. By mid-1972, some 140 persons, of whom McIntyre retained about 80, had gone through this form of training.

---

[1] Towards the end of 1973, there were indications that this problem was accentuated by manpower requirements of oil sands plants who need much the same personnel for their open pits as companies engaged in surface mining of coal.

In conjunction with Canada Manpower, McIntyre also conducted a 32-week on-the-job training program[2] which was less lecture-oriented and sought to prepare candidates for later certification under The Coal Mines Regulation Act.

Other companies, often able to meet their needs by employing "surplus" miners trained by McIntyre, have generally been less active and have confined themselves to sponsoring employees in courses leading to certification as electricians or mechanics under the Apprenticeship Board of Alberta. Some have also collaborated with the Board and with the Department of Advanced Education in establishing programs at NAIT and SAIT through which technologists with coal industry related competences could be trained.

There is now some divergence of opinion within the industry as to whether or not labour will prove a seriously limiting factor in expansion of existing mines and in development of new mining sites. There is agreement that shortages of experienced underground miners will remain acute for many years, and that continued in-house training of men for such employment will be essential, with some assistance from government agencies necessary. However, with respect to surface operations, some companies believe that manpower requirements in the various categories can be met by continuing sponsorship of trainees through programs leading to certification under the Apprenticeship Board. Others consider that larger numbers of qualified men will be attracted as the industry gains greater economic stability and thereby improves its public image.

This more optimistic view of future labour supply for surface mines is reflected, in part, in the growing reluctance of some operators to assist trainees through skill improvement courses. It is claimed that many of these men will leave

---

[2] Abandoned in 1973.

after completion of their training program for better paid positions elsewhere rather than return to the coal industry. If this is, in fact, a significant trend, the industry should be able to alleviate its manpower shortages through improvements in working conditions without seriously affecting the competitive position of coal.

In the course of its inquiry, the Board has become aware of one aspect related to working conditions which lies beyond the industry's control. In some communities, particularly the towns of Coleman and Canmore, acute shortages of land within municipal boundaries now effectively preclude the provision of new housing and amenities for mine workers; and the two companies operating near these towns consider this the most serious obstacle to attracting new men. The Board accordingly believes that current and foreseeable shortfalls in the supply of labour to Alberta coal producers can only be resolved by concerted actions involving several government departments as well as the industry. Without such action, labour shortages will undoubtedly restrain further coal industry development and, in the Board's view, also prolong instability in the industry through raiding or voluntary migration of men from company to company.

6.2.3 Policies Respecting Use of Public Lands

Social concerns about the presumed destructive environmental effects of surface mining (see Sec. 10), and the responses so far made to them, have created some uncertainty about the type, scope and location of future coal development. Pending clarification of provincial land use policies, a significant slowdown of exploration must be anticipated, with consequent delay in developing new production capacity.

On the whole, little difficulty appears to attend planning for coal development in the Alberta Plains. It is generally acknowledged that mining in that region need make little adverse

impact on the natural environment, and that high standards of surface reclamation here are not merely possible, but attainable at very modest cost.

More serious problems are, however, seen in the Mountain Region and, to a lesser extent, in the Foothills Region of the Province. These contain prime recreational and wilderness areas in which even transient aesthetic damage, let alone more permanent impact, is often considered fundamentally unacceptable. In response to widely voiced concerns, several large tracts of land which contain extensive reserves of metallurgical coal have been temporarily frozen by the Government of Alberta. In others, exploration is not only severely restricted, but sanctioned without giving the operator any reasonable assurance that he will be allowed to proceed to commercial development if the exploration program and demand for coal should eventually warrant it.

6.3 Pricing Trends

6.3.1 Thermal Coal

Having regard to the extent and location of already proved recoverable reserves of strippable coal in the Plains Region (see Table 3-2), and to the projected demand for such coal (see Sec. 7), the Board believes that prices over the forecast period will generally tend to reflect costs of production. Competition for coal in energy markets is expected to exert little direct upward pressure in prices during this period.

As annual production rates increase, mining may become more difficult, mainly because it will gradually become necessary to develop coal under greater overburdens. The Board believes, however, that this will be largely offset by economies of scale due to a trend toward large mines and by introduction of more efficient mining equipment.

At least until the mid-1980's, the cost of surface-mined thermal coal from the Plains Region, now available at mine-mouth power plants at 15 cents or less per million Btu, therefore,

is expected to escalate at 4 per cent per year. A higher "base rate" of 25 cents per million Btu, escalating at a similar rate, is not likely to make itself felt until sometime thereafter. A general projection of the 15 cent base rate (as contemplated in ERCB Report 73-C) is illustrated in Figure 6-2.

A corresponding relative price stability throughout the forecast period is also expected to prevail for surface-mined bituminous coal from the Foothills Region. Plains underground coal could be made available at certain locations at similar prices.

6.3.2 Metallurgical Coal

Largely governed by the commodity price of metallurgical coal in major world markets, prices of Alberta coking coal will undoubtedly rise more rapidly than those of thermal coal.

As matters stand, it is difficult to project the likely rate of price escalation during the forecast period. The Board believes, however, that the recent experience of the coal industry with mining in mountain terrain will help to moderate future increases in production costs and generally improve its competitive position in export markets.

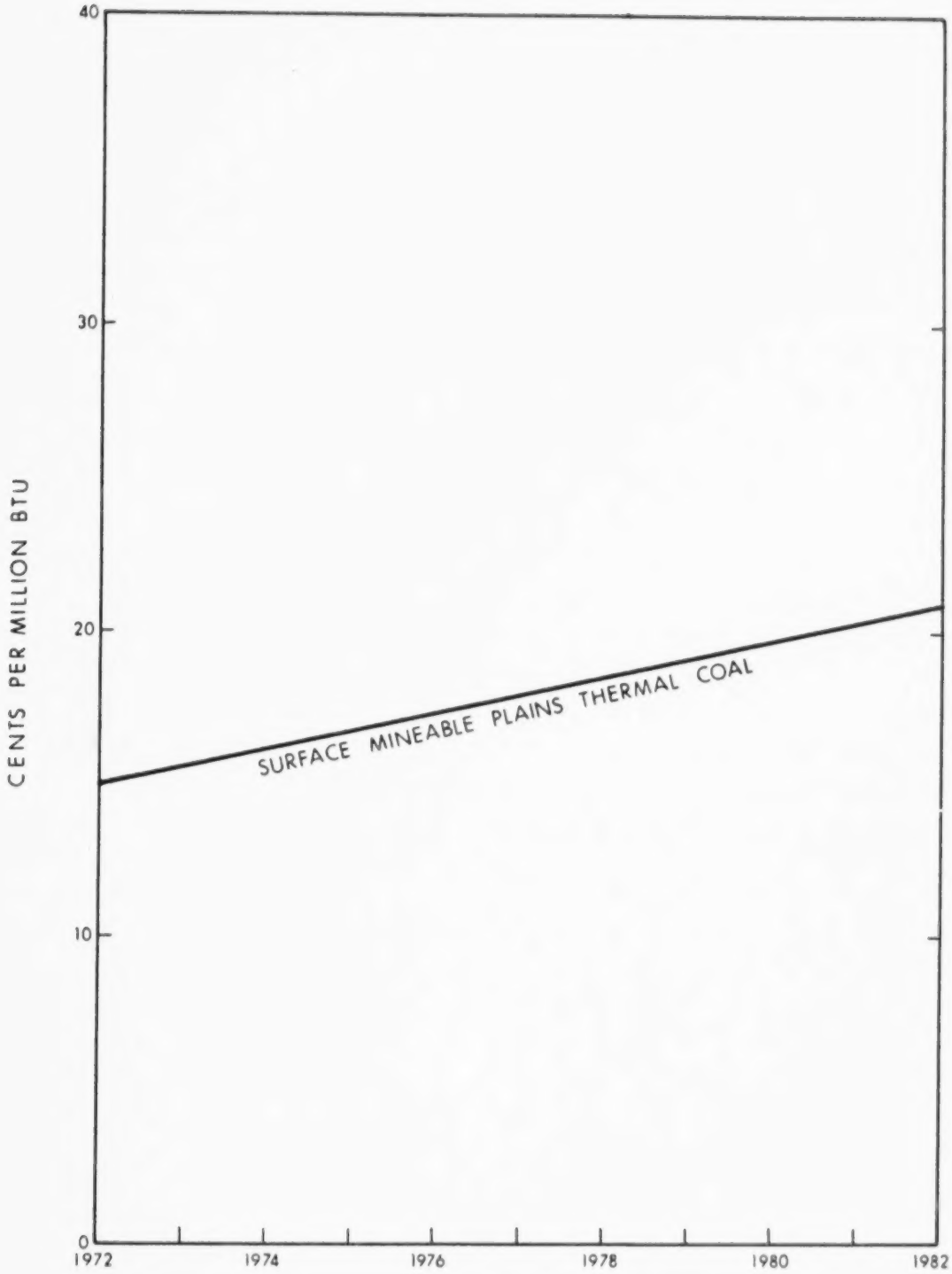


FIGURE 6-2 PROJECTED ANNUAL COAL PRICE FOR ELECTRIC ENERGY GENERATION IN ALBERTA

7 MARKETS AND MARKET PROSPECTS

The Alberta coal industry, now emerging from its depression of the 1950's and early 1960's, is still very much in a transition stage. Many of the major coal outlets that can be perceived at this time lie in potential rather than actual markets and depend on matters over which the industry has little control. The industry awaits, in particular, clarification of public policies respecting the conditions under which it is expected to operate; and there is also some uncertainty about how quickly and fully it can respond to new demand. In these circumstances, projections of coal demand and of the prices at which it will be available in various markets are critically dependent upon the particular assumptions on which they are based.

In discussing the most significant potential markets, the Board has adopted a conservative view of new developments likely to occur in the forecast period.

7.1 The Coal Market in Alberta

7.1.1 Thermal Coal

In the Board's report on "Choices among Energy Resources for Generation of Electric Energy in Alberta" (ERCB 73-C), it was shown that it would be in Alberta's public interest to fuel new thermal power plants in the Province with coal. Assuming that this course of action is followed, the primary demand for thermal coal will be for electric energy generation in the Province and coal consumption is expected to increase from an annual rate of 4.5 million tons in 1972 to about 11.6 million tons in 1980 and 14 million tons in 1982. A year-by-year projection of demand to 1982, based on projected demand for electric energy, is shown in Figure 7-1.

The Board believes that, in addition, there may also be some opportunity for exporting electric energy from Alberta to adjoining provinces and to the power pool in the U.S. Pacific

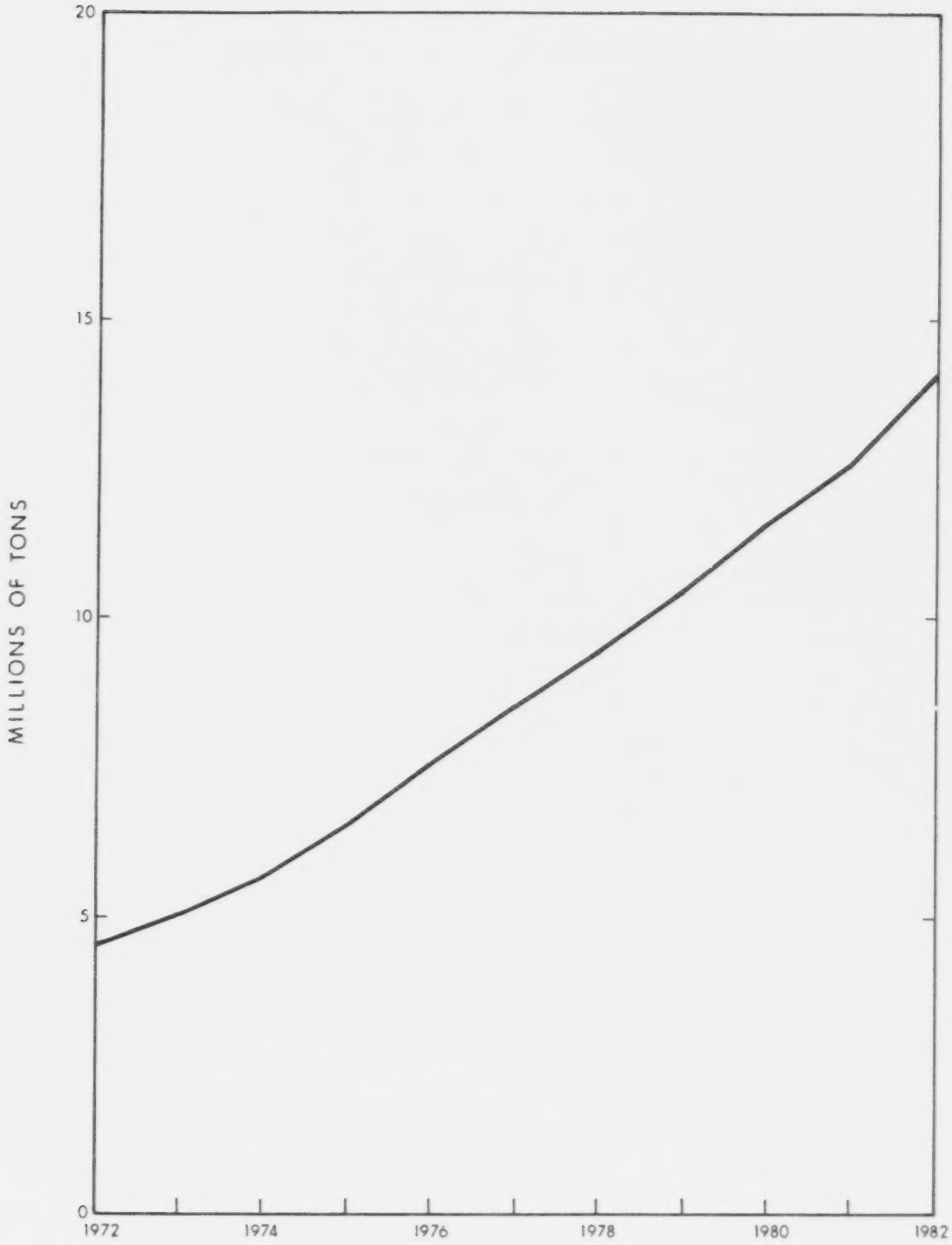


FIGURE 7-1 PROJECTED ANNUAL COAL DEMAND FOR ELECTRIC ENERGY GENERATION IN ALBERTA

North West. However, at present this is quite conjectural and the coal demand likely to be created by it is difficult to assess.

No significant coal demand is foreseen in Alberta's residential, commercial and industrial fuel markets, with the possible exception of some heavy industrial operations such as the manufacture of cement and of clay products. Substantial additional provincial demand for thermal coal could arise toward the end of the forecast period through decisions to supplement natural gas supplies with synthetic gas from coal (see Sec. 6.1.4.2). The scale of such operations and the actual coal demand is undetermined at this time, but the Board believes that coal gasification in Alberta may become a major industrial activity by the mid-1980's.

7.1.2 Metallurgical Coal

Future demand for metallurgical coal in Alberta is contingent upon the development of a blast furnace operation. Demand could range as high as 500,000 tons per year, but is not expected to develop before 1985.

7.2 Coal Markets in Ontario

7.2.1 Thermal Coal

The largest potential markets for Alberta thermal coal lie in Ontario where annual demand for generation of electric energy presently runs at approximately 11 million tons (at 13 thousand Btu's per pound). All requirements are now met by imports from the United States.

Long term thermal coal demand in Ontario depends largely on whether Ontario Hydro can reach the targets set in its proposed extensive nuclear program. If it can do so, minimum annual coal requirements are expected to be some 22 million tons (at 13 thousand Btu's per pound) by the early 1980's and then gradually diminish beyond 1990 as coal-fired plants are retired and replaced

by nuclear installations. Any significant shortfall in implementation of the nuclear program would, however, extend Ontario's heavy reliance on coal for electric energy generation into the 1990's.

The Board believes that the most significant factors directing Ontario's attention to the use of Western Canadian coal are its environmental advantages (offered by its low sulphur content) and Ontario's need to diversify its sources of supply.

Since 1970, Ontario has implemented environmental legislation which limits the allowable sulphur emission into the atmosphere and prevents the conventional use of coal with high sulphur content as a boiler fuel. Ontario Hydro responded to this legislation by converting some coal-fired generating capacity to natural gas, by resorting to partial oil firing at other stations, and by utilizing a coal mix that could meet the new environmental standards. However, recent increases in the price of oil and gas and expectations of escalation in the price of these fuels in the future tend to provide Alberta low sulphur coals with competitive leverage in Ontario. Ontario has, in fact, already publicly confirmed its intention to secure significant volumes from Western Canadian reserves. In part, this may have been prompted as much by the recognition that international supplies are limited, as by a desire to support national energy policies.

Having regard to these matters, the Board believes that Ontario's potential use of Alberta thermal coal during the 1980's will increase to some 10 million tons annually. The Board expects that all deliveries to Ontario Hydro during the forecast period will, beginning in 1977, come from high-volatile Foothill reserves and so assure that existing boilers designed to burn 12,000 to 12,500 Btu's per pound coal will not require significant derating.

7.2.2 Metallurgical Coal

Steel makers in Ontario currently use some 7.5 million tons of metallurgical coal for manufacture of blast furnace cokes. An economically viable system for transporting thermal coal to Ontario would also allow the Alberta coal industry to supply up to 4 million tons per year of metallurgical coal to Ontario steel makers[1] and to meet a part of the demand of the major steel companies who currently obtain coal from U.S. mines. (In some cases this coal comes from mines in which the steel companies have an equity interest.) There appears to be little doubt that Alberta metallurgical coal could meet the steel makers' specifications. Acceptability would therefore be determined mainly by the competitive position of such coal with American coal which is currently laid down in Toronto at approximately $20 per ton.

7.3 Coal Markets in Saskatchewan

7.3.1 Thermal Coal

A smaller potential market for Alberta thermal coal lies in Saskatchewan where it would be used to augment indigenous supplies of lignite for generation of electric energy. For a short period in the mid-1960's, sales of Alberta coal were made to Saskatchewan at annual rates as high as 250,000 tons per year. However, considering the emphasis which Saskatchewan now places on development of its lignite reserves, and to the projected demand for electric energy in that province, the Board does not consider that the Saskatchewan utility market will offer a substantial outlet for Alberta coal during the forecast period. On the contrary, Saskatchewan is more likely to become an exporter of lignite, competing against Alberta coal in Ontario.

7.3.2 Metallurgical Coal

The Board does not believe that Saskatchewan offers a

---

[1] McIntyre Porcupine Mines Ltd. recently sent a complete unit-train-load (approximately 10,000 tons), trans-shipped at the Lakehead, to the Steel Co. of Canada at Hamilton.

potential market for Alberta metallurgical coal during the forecast period.

7.4 Markets in Japan

7.4.1 Thermal Coal

Since Japan now pays in excess of 90 cents per million Btu for imported low-sulphur oil and gas used for generating electric energy, and is likely to face considerable difficulties in securing future supplies, the Japanese utility fuel market holds obvious potential for Alberta thermal coal. Access to this market depends upon a basic change in the Japanese government's present fuel import policies which are designed to protect the coal industry in Japan. The Board has been informed that Japan's embargo on import of thermal coal will shortly be terminated and, accordingly, believes that long-term arrangements, initially calling for shipments of between 1 and 3 million tons per year, can be anticipated. It expects the market to require high-volatile bituminous coal, a type that would allow safe transportation (see Sec. 6.1.2) and offer higher heat content (about 11,000 to 11,500 Btu/lb. as compared with 8,000 Btu/lb. for Plains strip-mined coal). Coal industry sources indicate that such coal, surface-mined in the Foothills Region, could be laid down in Japanese ports at currently competitive rates.

Should Interprovincial's proposed coal-oil slurry transport scheme (see Sec. 6.1.3) prove successful, the sale of thermal coal to Japan could perhaps ultimately be tied in to Japanese interest in purchases of synthetic crude oil from the Alberta Oil Sands, and so allow operation of a slurry pipe line to the Pacific Coast. Trans Mountain Pipe Line Company's facilities could afford a convenient means for such an operation.

7.4.2 Metallurgical Coal

Recently updated estimates by Japanese government agencies project the annual demand of Japanese steel makers for imported

metallurgical coal as escalating from 64 million tons in 1973 to approximately 98 million tons in 1982. While substantial purchases may in the future also be made in China and in the Soviet Union, the principal sources of supply are generally in Canada, the United States and Australia. (These countries currently furnish 16, 25 and 37 per cent respectively of all metallurgical coal used in Japan.) Potentially, the Japanese iron and steel industry thus represents the largest and, in addition, an expanding long-term market for Canadian metallurgical coal.[2]

From information obtained in the course of its inquiry, the Board concludes that total Canadian shipments of metallurgical coal to Japan may reach about 21 million tons annually by 1982. Approximately 10 million tons, or 48 per cent of this total, could come from Alberta mines. More detailed projections are shown in Table 7-1, which also indicates the anticipated Canadian shares of Japanese offshore purchases.

Without going beyond already proved recoverable reserves of metallurgical coal, the Board believes that the projected Alberta sales to Japan - which would require development of three or four new mine complexes in the Mountain Region - could be made without foregoing marketing opportunities that may present themselves elsewhere. Provided land use policies do not prevent mining in the most promising coal-bearing areas in the mountains, the Board also believes that Alberta producers will be able to maintain the favourable competitive position which they presently enjoy in Japan. The relative position of Australian, Canadian and American coal - presently laid down in Japan at approximately $18, $22 and $27 respectively - is unlikely to change much against Canadian producers. However, in the light of earlier problems which Canadian producers have

---

[2] While the current energy crisis in Japan, largely arising from cutbacks in oil production in the Middle East, may require internal readjustments, it is unlikely to affect substantially Japan's demand for imported metallurgical coal.

Table 7-1

PROJECTED JAPANESE DEMAND/SUPPLY FOR COKING COAL
Millions of Tons

DEMAND	1973	1974	1975	1976	1977	1980	1982
Crude Steel Production	130	138	148	156	165	176	192
Pig Iron Production[1]	104	110	118	125	132	141	154
Coal/Pig Iron Ratio	.72	.71	.71	.70	.69	.69	.69
Coal Required	75	78	84	88	91	97	106
SOURCE							
Domestic	11	10	9	8	8	8	8
U.S.A.[2]	19	20	21	22	23	25	27
Australia[4]	27	28	30	31	31	31	31
Canada	12	14	15	16	17	20	21
U.S.S.R.	4	4	4	4	4	5	8[3]
Poland	2	2	2	2	2	2	2
South Africa	-	-	3	3	3	3	3
China	-	-	-	2	3	3	6[3]
	75	78	84	88	91	97	106

[1] Pig iron = crude steel x 0.8.

[2] Assumed that U.S.A. will continue to supply 25% of requirement.

[3] Assumed that most of incremental demand will be split between U.S.S.R. and China supply.

[4] Australia - assumed that supply quantity will be maintained but no increase.

experienced, and which have in some instances resulted in production shortfalls as well as required price redeterminations, the Board expects Japanese purchasers to become more cautious in making further commitments and, in particular, to demand more explicit demonstration of the producers' ability to adhere to contract terms.

7.5 Markets in the United States

As a result of grave concerns about the security of future oil and gas supplies from the Middle East and North Africa, and recognition of the enormous annual capital outflows that would result from a policy of meeting internal oil and gas deficits by purchases abroad, the United States is now seeking energy self-sufficiency by the mid-1980's.

This objective will be reached, in large measure, by heavy reliance on substitute natural gas (SNG), low-Btu fuel gas, and synthetic liquid fuels from coal. Announcements in the U.S. indicate that, over the next 5 years, the better part of $10 billion will be spent on developing the required advance coal mining, gasification, and liquefaction technologies.

U.S. authorities recognize that the resultant rapid escalation of coal demand, from about 590 million tons in 1972 to a targeted 1.5 billion tons in 1985, will place severe strains on productive capacity and make some shortfalls virtually inevitable. The Board expects that this may afford Alberta coal producers opportunities for marketing substantial tonnages of thermal as well as metallurgical coal in the U.S.

The initial impact of the new policy is likely to cause a tightening of supplies of metallurgical coal; thus a limited demand for such coal from Alberta could develop at almost any time. (McIntyre's recent renegotiation of its contract with Japanese consumers appears to reflect the same recognition).[3]

---

[3] McIntyre recently completed shipments (in total approximately 200,000 tons) to Bethlehem Steel Corporation's steelworks in Maryland via the Panama canal, and to United States Steel Corporation's works in Gary, Indiana via rail to the Lakehead and Great Lakes shipping facilities.

While the present situation is too uncertain to allow even tentative projections, the Board believes that annual sales of metallurgical coal could exceed 1 to 2 million tons before the end of the decade.

Alternatively, if the U.S. should seek to alleviate shortages by curtailing bituminous coal exports to Western Europe and Japan, which now run at approximately 56 million tons annually, Alberta producers may be able to substitute in those markets.

Having regard to the large requirements of thermal coal for gasification, liquefaction and generation of electric energy, the Board also believes that potential demand for subbituminous and high volatile bituminous coals from the Plains and Foothills regions may exceed the tonnages which Alberta could make available. It notes, in this connection, that plans call for the pipe line movement of up to 15 million tons per year to Ontario (see Sec. 6.1.3) and disposal of about half of this tonnage in the Eastern U.S.

7.6 Markets in South America

Recent discussions with representatives from Brazil indicate its strong interest in Alberta metallurgical coal. However, purchases by that country appear to be contingent on a bilateral agreement in which Brazil would buy Canadian coal and Canada, in turn, would buy Brazilian iron ore or iron ore concentrates.

Brazilian steel production is projected to increase from approximately 7 million tons in 1972 to 20 million tons in 1978 and 30 million tons in 1980. Coal requirements are therefore estimated to rise from some 4 million tons in 1972 to 16.5 million tons in 1980. Of this total, about 5.5 million tons are and will continue to be produced in Brazilian mines, even though the local coal is recognized to be of inferior quality. The level of imports is consequently estimated to rise to 11 million tons per year by 1980; and the Board believes that Brazil may offer

an outlet for between 2 and 4 million tons of Alberta metallurgical coal annually during the next decade.

7.7 Markets in Western Europe

Reflecting the developing shortages of economically recoverable high-grade metallurgical coal in older industrialized countries, both Britain and the Federal Republic of Germany are now actively seeking supplies of Western Canadian coking coal.

The British Steel Corporation, a publicly owned enterprise which currently produces more than 90 per cent of Britain's steel, has indicated an annual need for some 4.5 million tons of coal from Canada, beginning in the late 1970's. About half of this total would be medium-volatile bituminous coal, and the remainder would be low-volatile bituminous coal or semi-anthracite of the type now mined in the Canmore area. The Board understands that British Steel would prefer to enter into long-term purchasing agreements with Canadian suppliers, but would consider a joint venture if this should prove necessary in order to develop a suitable new source of coal.

German interests are represented by a consortium of the country's largest steel makers and their affiliates in Italy and the Netherlands. Acting on behalf of this consortium is Exploration & Bergbau G.m.b.H. of Dusseldorf, a technically-oriented company which has already sent two missions to Alberta and has recently also opened an office in Calgary. Exploration & Bergbau has indicated that it seeks tonnages similar to those required by British Steel, and that its principals are prepared to undertake a joint venture or, if necessary, to develop a new mine site on their own.

In all cases it is planned to transport the coal to its final destination via West Coast facilities.

7.8 Total Markets and Forecast Production

The Board is generally optimistic that extensive new demand for Alberta thermal and metallurgical coal will develop within the forecast period, and considers that the rate of development may well be determined by the capability of the industry to bring reserves into production. For purposes of this summary the Board has, therefore, deliberately projected a conservative estimate which may serve as a basic framework for the industry.

7.8.1 Thermal Coal

The Board believes that transportation constraints will be solved and thus allow sizeable tonnages of thermal coal from Alberta to move to Ontario. In its forecast the Board assumes initial sizable shipments will begin in 1977, reach levels of 8 million tons annually by 1978 and increase to 10 million tons by 1982. The Board expects that this coal will come from high-volatile Foothills coal reserves (see Figure 7-2).

In view of the constraints on the industry, and of rapidly increasing coal demand within the Province it may be optimistic to assume that large volumes of thermal coal will go to markets such as Japan and other foreign markets within the next 10 years. Accordingly, the Board has omitted these from its forecast of production but does not exclude the possibility of smaller shipments to foreign markets during the forecast period.

Total requirement for electric energy generation within Alberta is expected to result in increased annual production of coal from 4.5 million tons in 1973 to 14 million tons in 1982.

7.8.2 Metallurgical Coal

The Board has assumed that sizable increases in volumes of metallurgical coal will be destined to Japanese markets over the forecast period. As shown in Figure 7-3, it expects annual shipments of processed coking coal to Japan to increase from 4.3 million tons in 1973 to 10.6 million tons by 1982 and to require

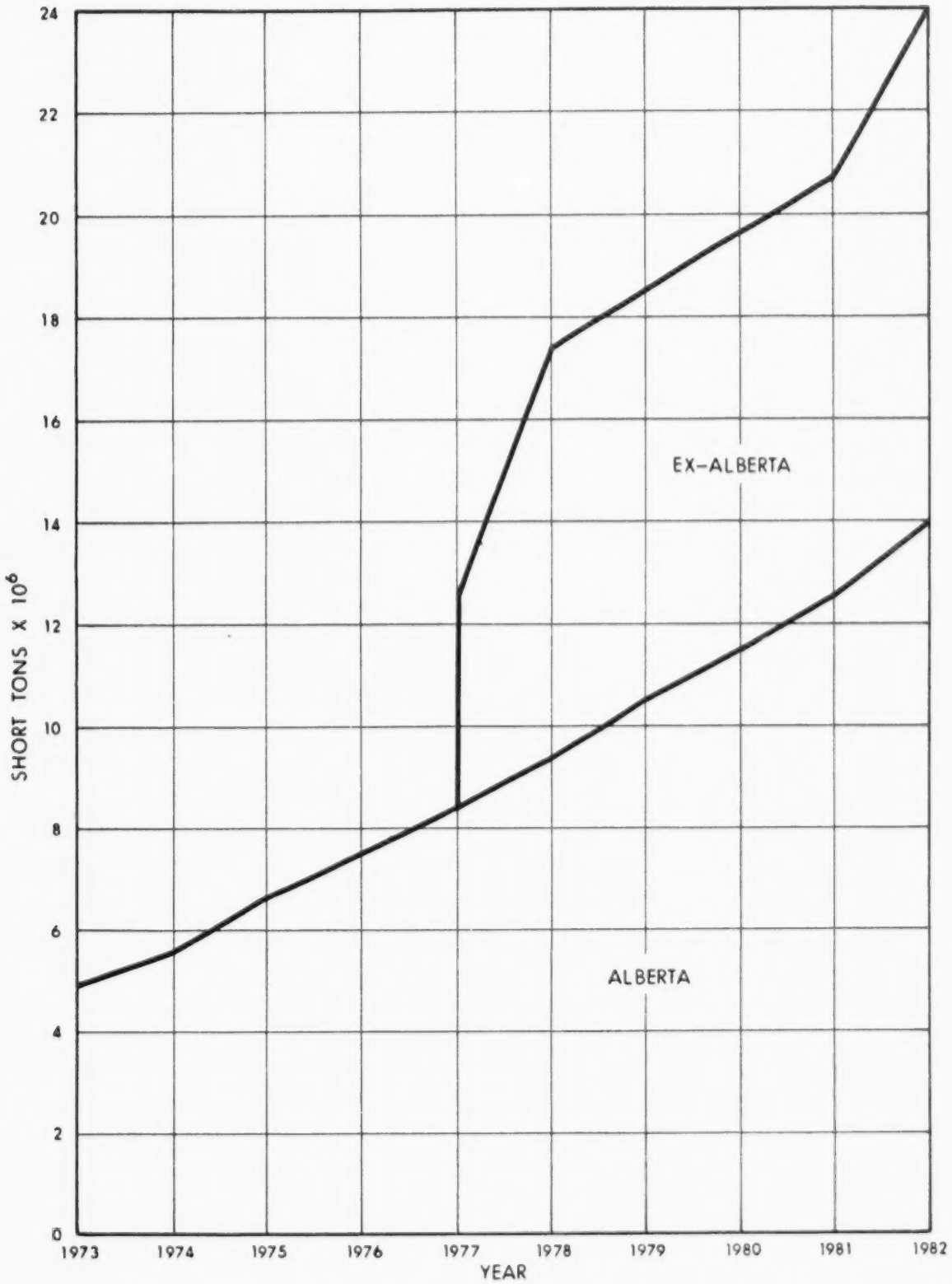


FIGURE 7-2 FORECAST OF THERMAL COAL PRODUCTION IN ALBERTA

ENERGY RESOURCES CONSERVATION BOARD
CALGARY, ALBERTA FEBRUARY 1974

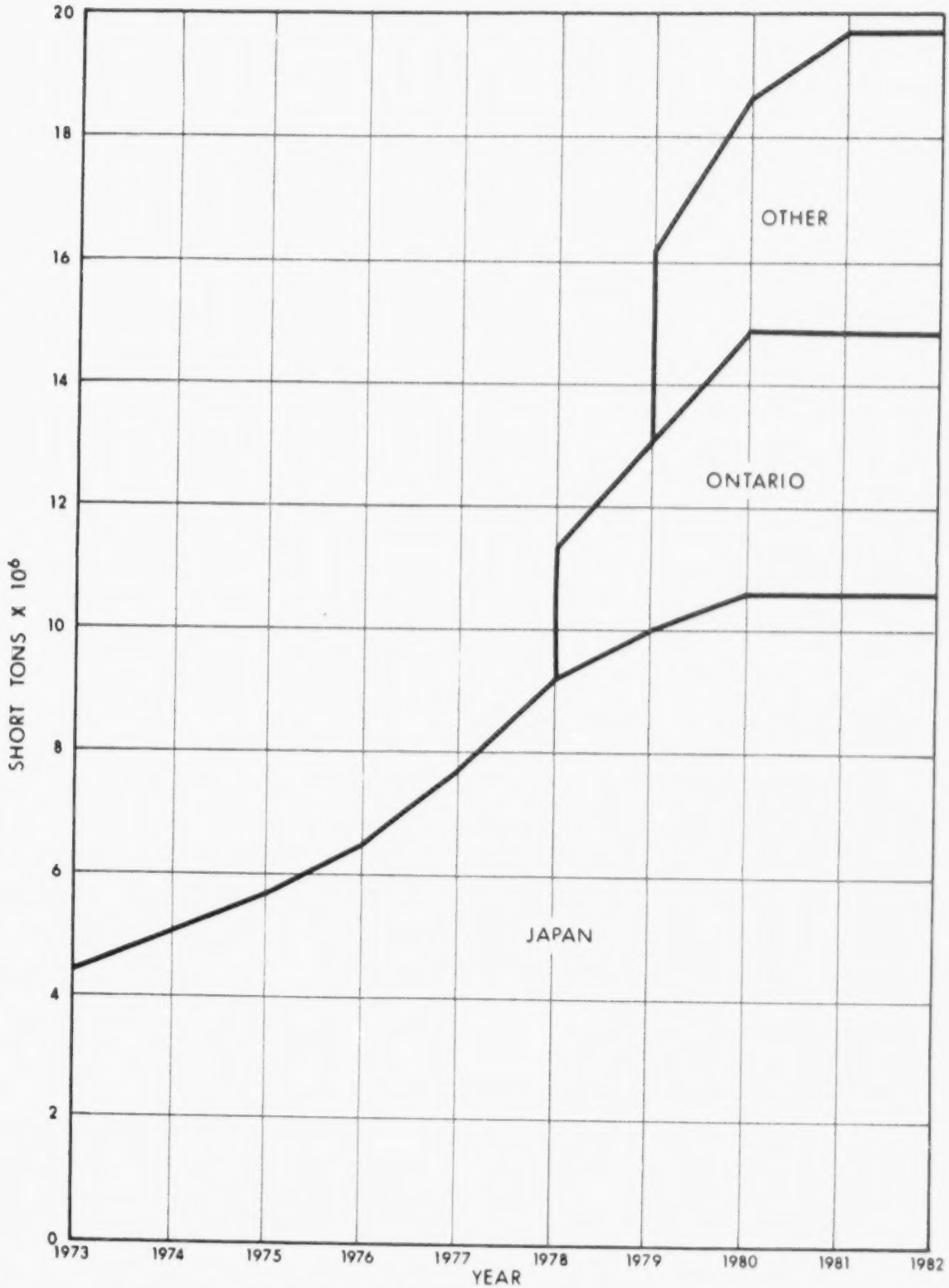


FIGURE 7-3 FORECAST OF PROCESSED METALLURGICAL COAL PRODUCTION IN ALBERTA

ENERGY RESOURCES CONSERVATION BOARD
CALGARY, ALBERTA FEBRUARY, 1974

the development of three or four new mines. The equivalent increase in production of raw coal would be from 5.7 million tons in 1973 to 14.1 million tons in 1982.

The Board also expects export of coking coal to Ontario. Significant shipments should begin by 1978 and increase to 4 million tons annually as the steel industry replaces some of its U.S. supplies with domestic sources (see Figure 7-3).

In addition to the above, the Board also believes that the prospects for coking coal exports to Europe and South America will be realized during the latter part of the forecast period. For its forecast in Figure 7-3 it has shown the production for these markets to commence in 1979 and to reach 5 million tons annually by 1981.

8 CURRENT AND PROJECTED ACTIVITIES, EXPENDITURES AND EMPLOYMENT

8.1 Exploration

Since resumption of coal exploration in Alberta in the early 1960's, this activity has intensified to a level of expenditure of some $3 million annually. However, almost all exploration has been confined to the Plains and Mountain Regions, and has been concentrated on near-surface coal deposits that are recoverable by surface mining under current and near-term economics. Very little work on deeper coal, requiring underground mining, has so far been undertaken, and lack of interest in high-volatile bituminous coal has restrained exploration in the Foothills Region.

Total expenditures on exploration in the 10-year period to 1972 are estimated at approximately $27 million. Virtually all manpower, equipment and supplies were drawn from within Alberta; and several programs also made fairly extensive use of consultants in private practice in the Province.

The areas in which major exploration programs were carried out during the past several years, and the companies who conducted or sponsored them, are identified in Figure 8-1.

The Board anticipates that expenditures on exploration over the next decade will average between $3 and $4 million annually, and that exploration activity generally will be more concerned with defining recoverable reserves in selected areas than with locating new deposits. However, expanding demand for thermal coal is likely to intensify field work in the Foothills Region, and some attention, almost certainly, will also be given to Plains underground coal.

The Board notes in this connection that plans are currently being developed by the Government of Alberta and the Research Council of Alberta for a 3 to 5-year exploration program designed to establish reserves of deep coal in the Alberta Plains Region.

This program will be funded by the Government of Alberta and is expected to cost about $500,000 annually.

8.2 Mining

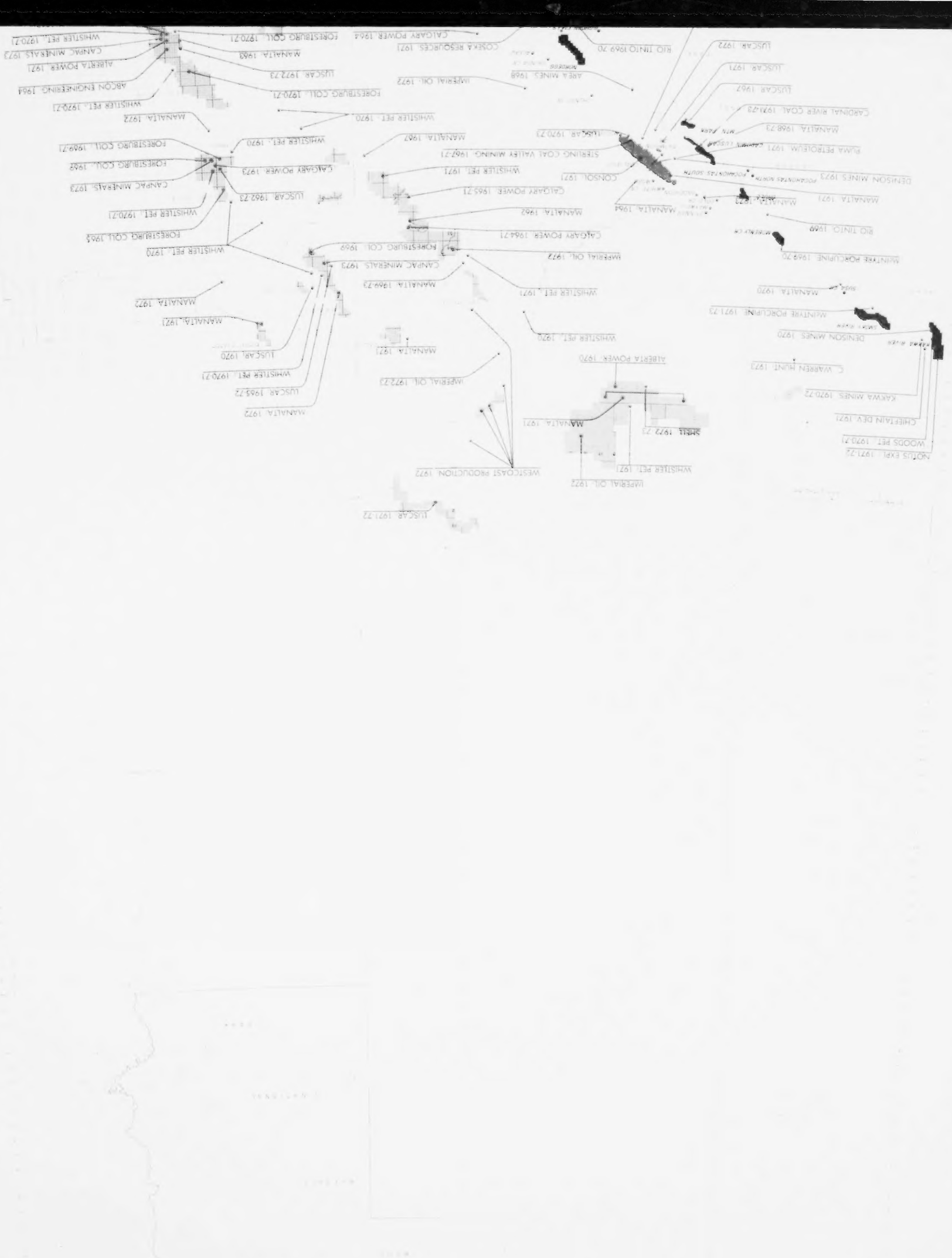
Of the 30 mines now being worked in Alberta and identified in Figure 3-2, 12 are small Plains strip mines which, on average, produced less than 10 thousand tons in 1972. Limited to meeting the still shrinking residential coal demand, these ventures are usually only operated during winter months, when they offer supplemental employment to persons engaged at other times of the year in farming or farm-related work. In many instances even mining equipment itself is drawn from seasonally idle farm machinery. Direct capital investment in them is, therefore, small and annual operating expenditures are insignificant.

The Board believes that these small mines will require significant injections of new capital to remain viable. Some are likely to close as remaining residential-commercial coal markets in Alberta are taken over by natural gas under the Provincial Government's rural gasification program. And others, endowed with more extensive potentially recoverable coal reserves or sited adjacent to such deposits, may expand their operation or be acquired by companies looking to large-scale production of thermal coal for provincial or extraprovincial utility fuel markets. (Luscar's recent take-over of the Burnstad Coal Co. is an example of the latter situation.)

For all practical purposes, the producing arm of the total Alberta coal industry can therefore be identified with eight mining operations, whose annual output of raw coal currently ranges from approximately 0.25 to over 2.5 million tons (see Table 8-1).

8.2.1 Mining in the Mountain Region

The Board estimates that development of new mining facilities (exclusive of processing plants) required to meet long-term commitments to Japanese consumers up to 1972 involved construction


WHISTLER PET. 1970-71
CANPAC MINERALS 1973
ALBERTA POWER 1971
ABCON ENGINEERING 1964
WHISTLER PET. 1970-71
MANALTA 1972
FORESTBURG COLL. 1969-71
FORESTBURG COLL. 1969
CANPAC MINERALS 1973
WHISTLER PET. 1970-71
FORESTBURG COLL. 1963
WHISTLER PET. 1970
MANALTA 1972
MANALTA 1971
LUSCAR 1970
WHISTLER PET. 1970-71
LUSCAR 1963-72
MANALTA 1972
FORESTBURG COLL. 1970-71
MANALTA 1968
LUSCAR 1972-73
IMPERIAL OIL 1972
WHISTLER PET. 1970
MANALTA 1972
CALGARY POWER 1973
LUSCAR 1962-73
CALGARY POWER 1964
COSEKA RESOURCES 1971
IMPERIAL OIL 1972
WHISTLER PET. 1970
MANALTA 1967
STERLING COAL VALLEY MINING 1967-71
WHISTLER PET. 1971
CALGARY POWER 1965-71
MANALTA 1962
CALGARY POWER 1964-71
FORESTBURG COL. 1969
CANPAC MINERALS 1973
MANALTA 1969-73
IMPERIAL OIL 1972
WHISTLER PET. 1971
WHISTLER PET. 1970
MANALTA 1971
IMPERIAL OIL 1972-73
WESTCOAST PRODUCTION 1972
IMPERIAL OIL 1972
WHISTLER PET. 1971
MANALTA 1971
ALBERTA POWER 1970
SHELL 1972-73
LUSCAR 1971-72
RIO TINTO 1969-70
AREA MINES 1968
LUSCAR 1970-72
CONSOL 1971
LUSCAR 1972
LUSCAR 1967
CAROLINAL RIVER COAL 1971-73
MANALTA 1968-73
PUMA PETROLEUM 1971
DENISON MINES 1973
MANALTA 1971
MANALTA 1964
RIO TINTO 1969
MINTYRE PORCUPINE 1969-70
MANALTA 1970
MINTYRE PORCUPINE 1971-73
DENISON MINES 1970
C. WARREN MUNT 1973
KAKWA MINES 1970-72
CHIEFTAIN DEV. 1971
WOODS PET. 1970-71
NOTUS EXPL. 1971-72

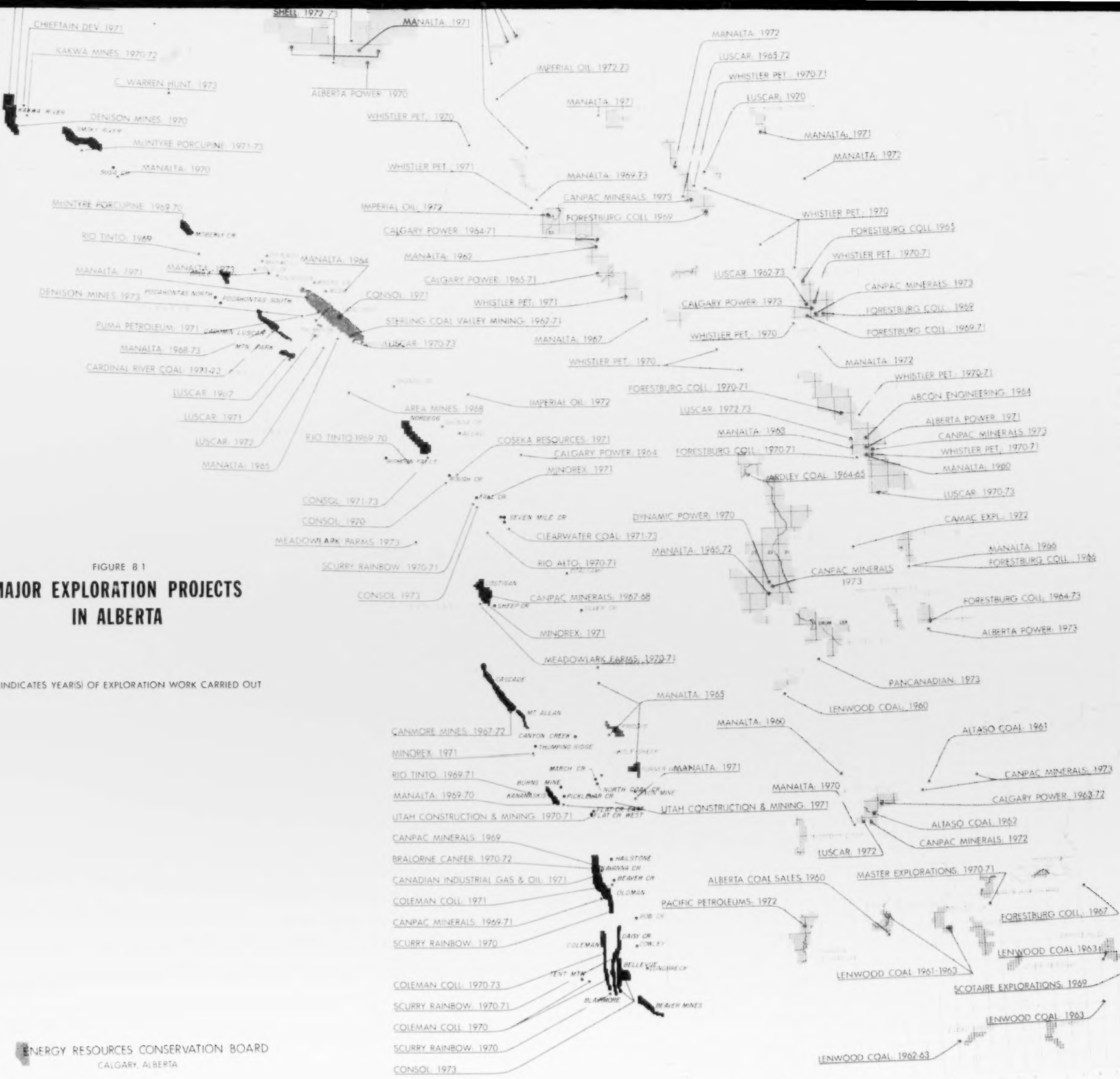


FIGURE 8 1

MAJOR EXPLORATION PROJECTS IN ALBERTA

DATE INDICATES YEAR(S) OF EXPLORATION WORK CARRIED OUT

ENERGY RESOURCES CONSERVATION BOARD
CALGARY, ALBERTA

costs and capital investments totalling some $72 million. Of this, approximately $46 million were expended by McIntyre, $14 million by Cardinal River, and $12 million by Coleman Collieries. In all instances, extensive debt financing was used, and all three companies accordingly carry large remaining debts. Only Canmore expanded its facilities without significant additional capital outlays.

Submissions to the hearing indicated that about 60 per cent of the total capital outlays were spent within Alberta, and that during the construction phase, which typically lasts about three years, some 1100 man-years of employment were provided.

Permanent direct employment at the four mines in mid-1973 stood at 1495 persons, distributed as shown in Table 8-2; but this total includes personnel operating coal processing plants (see Sec. 8.3), which are regarded as integral components of the mining operation, as well as general office and supervisory staffs.

Total annual operating expenditures, inclusive of taxes and royalty payments, are estimated by the Board at approximately $40 million. About 80 per cent of this total is spent within Alberta.

New long-term demand for Alberta metallurgical coal over the next decade is expected to require the development of at least six additional mine complexes, each with production. potentials up to 2 million tons per year. The localities in which proposals for such developments are anticipated include

(1) the Rock Lake area; Twp. 52, Rg. 3, W. 6th Mer. (Denison Mines),

(2) the Cregg River area; Twp. 47, Rg. 24, W. 5th Mer. (Manalta),

(3) the Nordegg area; Twp. 40, Rg. 15, W. 5th Mer. (Consolidation Coal of Canada), and

(4) Isolation Ridge; Twp. 13, Rg. 5, W. 5th Mer. (Granby Mining).

TABLE 8-1

MAJOR COAL MINING OPERATIONS IN ALBERTA

Name	1972 Production of Raw Coal (thousands of tons)
Subbituminous Coal	
Forestburg Collieries Limited (Diplomat Mine)	609
Manalta Coal Ltd. (Vesta Mine)	552
Manalta Coal Ltd. (Whitewood Mine)	2,232
Manalta Coal Ltd. (Highvale Mine)	1,308
Bituminous Coal	
The Canmore Mines, Limited	238
Cardinal River Coals Ltd.	1,619
Coleman Collieries Limited	939
McIntyre Porcupine Mines Limited	2,834

TABLE 8-2

EMPLOYMENT - MOUNTAIN REGION MINING (1973)

	Employees (July 1973)
McIntyre Porcupine Mines Limited	657
Cardinal River Coals Ltd.	191
Coleman Collieries Limited	490
The Canmore Mines, Limited	157
TOTAL	1,495

TABLE 8-3

EMPLOYMENT - MAJOR PLAINS REGION MINING

	Employees (July 1973)
Manalta (Whitewood)	101
Manalta (Highvale)	49
Manalta (Vesta)	46
Luscar (Diplomat)	42
TOTAL	238

With the exception of the Rock Lake site, where an underground hydraulic mining operation is being contemplated, all would involve open pit workings. Assuming developments for initial production of 1.5 million tons of processed metallurgical coal per year, each is estimated to require a capital investment of about $35 million (in 1973 terms); to incur annual operating expenditures of $11 million, of which approximately 60 per cent would be retained in Alberta; and to afford permanent direct employment for some 330 persons.

Denison's projected underground operation, initially for production of 0.5 million tons per year, is expected to incur a capital outlay of about $16 million and operating expenses of $7.50 to $9.50 per cleaned ton of production, of which some 60 per cent would be retained within the Province. Permanent direct employment of some 250 persons is anticipated.

8.2.2 Mining in the Plains Region

Since the early 1960's, rising requirements of thermal coal for generation of electric energy have led to the opening of two large new surface mines (Whitewood and Highvale) in the Lake Wabamun area, and to substantially expanded activity at two others (Diplomat and Vesta) in the Forestburg-Halkirk region.

Figure 8-2 shows year-by-year output from these mines since 1962.

The Board estimates that the collective capital investment at the four sites since 1962 amounts to approximately $21 million, of which about 40 per cent was spent in Alberta, and that annual operating expenditures run at about $4 million, of which 90 per cent is retained within the Province. Permanent direct employment in mid-1973 stood at 239 persons, distributed as shown in Table 8-3.

Projected increases in thermal electric energy generating capacity in Alberta to 1983 are expected to require opening of two additional surface mines in 1979 and 1983 respectively. The

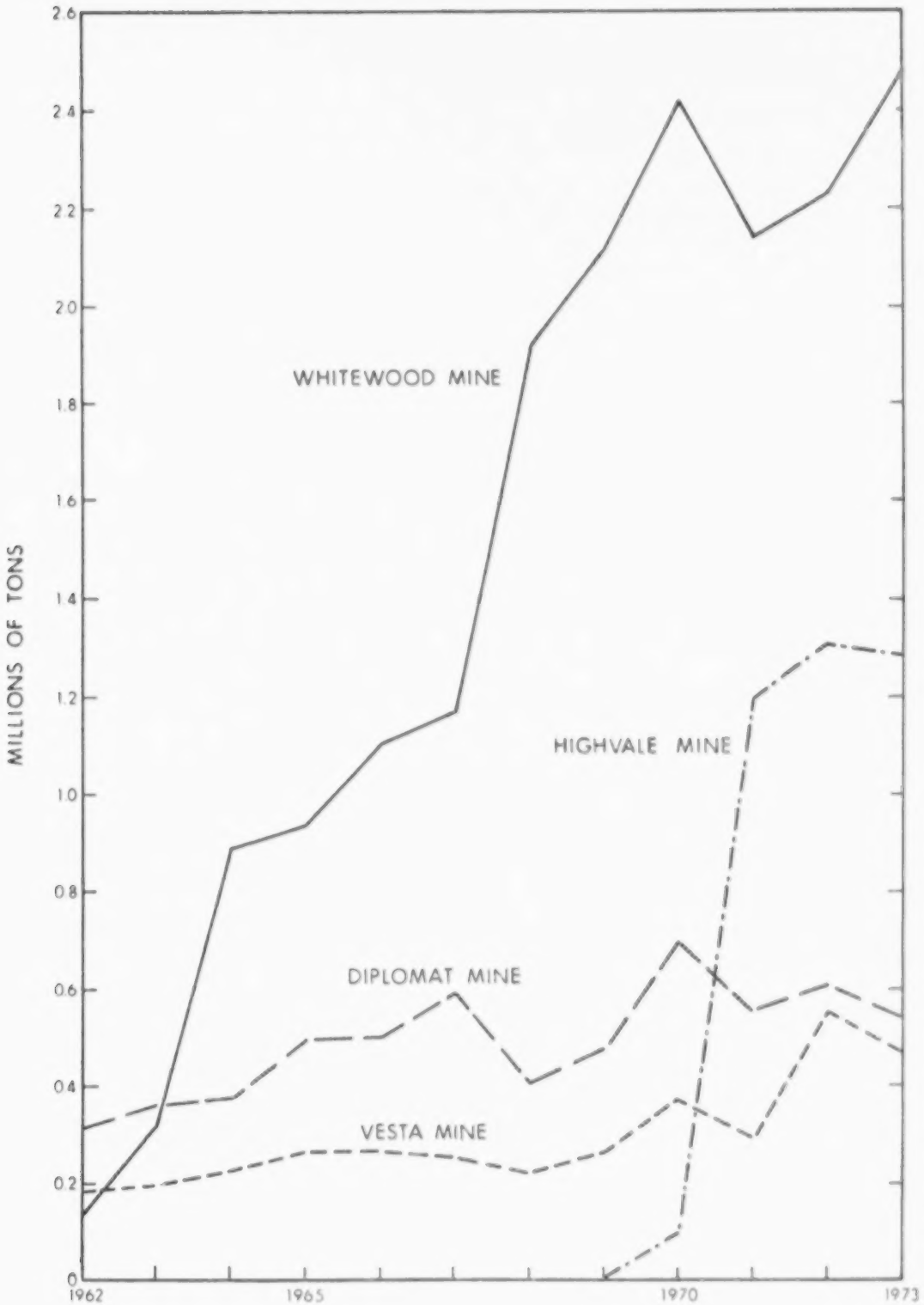


FIGURE 8-2 ANNUAL ALBERTA PRODUCTION OF THERMAL COAL FOR ELECTRIC ENERGY GENERATION 1962 - 1973

Board concludes from the Calgary Power submission at the hearing that capital investment in these mines to 1983 will aggregate in some $85 million, of which about $35 million are expected to be spent within Alberta, and that additional permanent direct employment will be offered to about 360 persons.

In addition, the Board believes that by the end of the 1970's up to 10 million tons of Alberta thermal coal will be annually contracted to extraprovincial markets. If this entire tonnage is produced in several Foothills surface mines, export commitments would entail capital outlays and annual operating costs of approximately $250 million and some $70 million respectively. Some 2200 permanent direct employment opportunities would be provided.

8.3 Processing

Aside from simple screening or crushing of raw coal to produce the sizes required by residential-commercial consumers and by electric energy generation, coal processing in Alberta is presently confined to mechanical cleaning of metallurgical coal. This operation reduces ash contents to the levels specified in the companies' contracts with their customers and yields a "rejects" fraction, typically 25 to 32 per cent of the raw coal feed, of which a portion is suitable for electric energy generation.

The four coal processing plants now in operation differ in size, layout, and equipment, but otherwise employ conventional coal processing technology.

The Board estimates that the existing processing plants in Alberta mines represent a total capital investment (inclusive of on-site construction costs) of approximately $30 million, of which about 40 per cent were spent on goods and services in Alberta. Annual operating costs aggregate some $6 million, of which at least 70 per cent appear to be retained in the Province.

Metallurgical coal mines opened in response to new demand over the next decade are expected to require substantially similar

processing facilities and, on the basis of the projections in Section 8.2.1, the Board estimates that some $135 million will be spent on such additional plants in the period to 1983. Annual operating expenditures of the new facilities would run at about $22 million and would continue to be mainly retained in Alberta.

8.4 Transportation

8.4.1 Rail Facilities

In the Plains Region, where the mines mainly serve mine-mouth thermal power plants, haul distances are generally less than 5 miles, and coal is carried to its delivery points by up to 65-ton capacity diesel-powered trucks which form part of the mine's equipment inventory. The entire transportation system, including all private haul roads, is thus an integral component of the mine complex, with initial costs and maintenance charges contained in the capital outlays and annual operating costs of the mine.

The same is true of transportation of raw metallurgical coal to processing plants in which it is processed before shipment to markets. Substantial additional capital investments and operating costs are, however, associated with the facilities by which the prepared coal is subsequently moved to dock installations at Vancouver.

Information provided by the railway companies indicates that facilities for an annual movement of 1 million tons demand a capital investment of approximately $10.2 million (comprised of $4.3 million for rolling stock, $2.4 million for trackage materials, and $3.5 million for labour), and require annual materials purchases in the amount of $1.15 million. Almost all capital and annual maintenance expenditures are for Canadian goods and services; and some 120 persons are directly employed in operating the facilities.

Proceeding from these data, the Board estimates that the current activity of the Alberta coal industry has incurred

capital investments of some $40 million in new transportation facilities, that these facilities involve annual operating expenditures totalling approximately $12 million, and that they afford employment for about 450 persons.

In addition, about $4 million of the annual operating costs of dock-side storage and handling facilities in Vancouver may be apportioned to coal operations in Alberta.

Annual revenues accruing to Canadian National Railways, Canadian Pacific Railways and the Alberta Resources Railway from transport of Alberta metallurgical coal amount to about $7.4, $4.0 and $0.9 million respectively.

Assuming that movements of Alberta metallurgical coal to extraprovincial markets (principally on existing mainline trackage) will rise from 3.6 million tons in 1972 to about 20 million tons annually by 1982, the Board estimates that in excess of $200 million will be spent on expansion of the transportation system, that annual operating expenditures will increase by about $20 million, and that an additional 2,560 persons will find employment in coal transportation. All benefits would increase proportionally if thermal coal were also to be moved by rail.

8.4.2 Port Facilities

Alberta coal delivered at the West Coast is presently handled in two dock facilities in the Vancouver area. These, and a third dock on the West Coast which presently only accepts coal from British Columbia, have considerable spare capacity.

Neptune Terminals Limited in Vancouver takes delivery of coal from McIntyre and Cardinal River (which are served by three and two unit trains respectively). The capital cost of the Neptune installations is estimated at $11.4 million, of which about 60 per cent was spent on Canadian goods and services. The remainder went to equipment purchased abroad. Annual operating costs amount to approximately $0.6 million per million tons of coal handled. In 1972, Neptune Terminals transhipped a total of 2.7 million tons

of Alberta coal, but the Board understands that the company could provide potential capacity for approximately 9 million tons annually without significant additional expenditures.

Coal from Canmore and Coleman Collieries is handled by Pacific Coast Bulk Terminals in Port Moody. In 1972 the facilities accepted 0.9 million tons of coal, but up to approximately 2.5 million tons annually could be accommodated.

Pacific Coast's capital costs apportioned to coal service are about $5.7 million, of which over 85 per cent went to Canadian goods and services. Annual operating expenditures, also virtually all spent in Canada, run to about $0.8 million per million tons of coal shipped.

Westshore Terminals at Roberts Bank, which currently takes coal from Kaiser Resources Ltd. and Fording Coal Ltd. in British Columbia, was constructed at a cost of $19.5 million, of which about 80 per cent were spent on Canadian goods and services. In 1972, some 5.3 million tons of coal were shipped from Westshore, but capacity could be expanded to about 13.5 million tons per year through additonal capital investments of less than $1.5 million. Annual operating costs amount to approximately $4.0 million, of which over 97 per cent are spent in Canada.

8.5 Marketing

Since metallurgical coal is now mainly sold under long-term contracts, and output of thermal coal is almost entirely determined by the requirements for electric energy generation, the current operations of the Alberta coal industry involve little marketing effort in the conventional sense of the term. Instead, potential new outlets are being explored by government agencies and senior company executives who subsequently also conduct negotiations respecting long-term sales agreements; and technical back-up is afforded by private consultants or provincial and federal research organizations.

In view of the fact that the economics of coal production now dictate high volume operations, and that the heavy capital and operating costs of a large modern mine hold implications for the Province as well as for the mine operators, the industry's insistence on establishing firm long-term sales agreements before developing a new coal property is as much in the public interest as in the interest of the coal companies. However, having regard to the fact that most potential new markets for Alberta coal are effectively controlled by industrial consortia or trading companies acting on behalf of industry groupings, the Board questions whether Alberta coal companies, acting singly, possess sufficient countervailing strength when negotiating contract terms.

Significantly, this matter is now also beginning to be raised in industry circles, and the Board is therefore led to believe that it may be timely to consider options for more concerted market development. In the Board's view, there would be merit in considering the establishment of some kind of industry-sponsored marketing agency. Such an agency would not only enhance the stability and image of the industry, but would also undertake such functions as establishing quality control and more effective bargaining, and offering important technical advantages in ensuring steady coal supplies to customers.

8.6 Summary

A summary of the Board's forecast of expenditures and future employment in the industry is outlined in Section 11.

9 IMPACT ON INDIVIDUAL COMMUNITIES

9.1 Introduction

To supplement the information received at the hearing and to obtain first-hand knowledge of the impact of the coal industry on communities adjoining and servicing it in Alberta, a team of Board staff visited the more important mining communities during 1973.[1] The following assessment is based mainly on detailed discussions with community officials, mining company representatives and provincial planning commissions.

In general, the primary social and economic impact of coal operations on the communities nearby arises from direct employment at the mine site and from the requirements of the mine and its related facilities for goods and services. The magnitude of this impact, however, can vary widely, and depends not only on the size of the mine labour force, but also on the previous mining history in the area and on whether the mining operation is being conducted in an isolated or densely settled part of the Province.

The immediate economic impact is most appropriately assessed in terms of direct, indirect and induced employment. Direct employment means employment at the mine site; indirect employment means employment in enterprises which operate in adjacent communities and serve the mine or the personal needs of mine employees and their families; and induced employment means employment elsewhere in manufacturing, supply, transportation and administration related to coal activity in or near the community. Where sufficient data were available, the Board has also attempted to reflect this impact by employment multipliers applicable to the particular community.

In some communities affected by mining developments, the impact was found to be diluted or difficult to identify, either

---

[1] For list of communities visited see Section 1.

because the mine labour force was relatively small, or because mining is only one of several industrial activities that sustain the community. In certain cases renewed or expanded coal mining had, in fact, merely improved employment opportunities for unemployed or underemployed residents, and coal activity was then reflected in expansion of existing service facilities and commercial ventures rather than in the construction of new ones.

In all communities considerable importance was also attached to new opportunities for investment in residential, commercial, recreational and service sectors which the coal activity created. The environmental impact of the industry on the individual communities is a further matter of importance.

9.2 Impact on Communities in the Mountain Region

9.2.1 Grande Cache

Established in conjunction with McIntyre's mine site on the Smoky River, some 80 miles north of Hinton, Grande Cache is, from several points of view, a unique community. It serves a mining operation which currently employs a larger work force than any other in the Province, and it is for all practical purposes a one-company town which is wholly dependent on coal development. In January 1973, unexpected technical and economic difficulties compelled McIntyre to abandon its No. 5 underground mine, reducing its labour complement by some 206 employees to 660 persons, and leaving the town with a surplus of facilities. The Board notes in this connection that between late 1972 and mid-1973, the permanent population of Grande Cache fell by some 1,000 persons to 2,500.

However, subject to the recognition that expenditures and revenues to 1972 must be scaled down to fit the circumstances that now exist, the town affords a convenient barometer for gauging the maximum direct and indirect impact of coal activity.

In July 1973, 657 persons were engaged in coal mining at Grande Cache. Of these, 471 were employed by McIntyre, and 186 by Grande Resource Management Ltd. which operates the open pit mines on behalf of McIntyre. The average annual income was about $10,000 for underground miners and $11,000 for employees of Grande Resource Management Ltd.

In addition, 42 persons were employed by Alberta Power in connection with its H. R. Milner power plant.

Indirect employment accommodated approximately 420 persons, of whom 183 worked in the town's commercial enterprises, 157 in various town services, and 180 in other ventures indirectly related to the mine site.

The ratio of direct to indirect employment at Grande Cache is therefore close to 1:0.6.

To provide for the total work force and dependents, as well as for the approximately 1,000 people who left Grande Cache in the wake of the No. 5 mine closure, some $26 million were spent on construction projects which afforded employment for an estimated 1,400 persons. Major components inventoried by the Board are:

(a) residential construction of some 570 single-family homes and duplexes, 166 apartments, and facilities for 210 trailers;

(b) commercial construction of 37 separate business ventures;

(c) schools and medical facilities built at an estimated cost of $1.83 million; and

(d) a social and recreational complex (including a library, swimming pool and skating rink) built at a cost of $900,000.

A notable feature of development at Grande Cache is the extent of McIntyre's financial support of home construction. Aside from contributing $300,000 towards the cost of the recreational complex, the company has invested about $2.6 million in

housing, and currently holds home mortgages totalling $8.9 million. It has sought to encourage home ownership by enabling its employees to purchase fully serviced houses without down payment and subsidizing them with monthly grants up to $100 toward their mortgage payments. Details of this policy are included in Appendix C.

By 1972 municipal revenues accruing from assessments against property and business, per capita grants, and other subsidies had risen to a level of $2.24 million annually. Government contributions were approximately 25 per cent of this total.

Although Grande Cache now affords access to a large, hitherto effectively "closed" recreational area, tourism has so far made little impact on the town. The Board expects that this will become increasingly important in time and that the facilities of Grande Cache will act as a major spur to such development.

Mining near Grande Cache has no direct environmental impact on the town because the mines and townsite are physically separated in adjoining valleys. The underground mines create some visual effects through portal entries and temporary coal stockpiles near the portals. In view of prior land disturbance by the construction of the railbed of Alberta Resources Railway which cuts into the mountainside, the effect of surface mining on the east slope of the Smoky River Valley is minimal. The No. 8 mine has disturbed some 2 miles along the east side of Sheep Creek Valley but this land is now being reclaimed. Future disturbance in connection with development of the No. 9 mine will be on the west side of the valley. Comprehensive studies are in progress with a view to establishing an acceptable reclamation plan. The effects of mine effluents on neighbouring streams are continuously monitored.

9.2.2 Hinton

A case where coal mining is one of several industrial operations is provided by the Town of Hinton which is economically supported by oil and gas activities, a pulp mill, and tourist traffic on the Yellowhead Highway, as well as by Cardinal River's coal operations at Luscar.

Cardinal River's work force stands currently at 191 employees with an average annual income of about $12,000. Approximately 80 per cent live in Hinton, with the remainder equally divided between Cadomin and Robb. However, since a Board survey indicated that some 25 to 30 per cent of the company's labour complement were Hinton residents before mining operations commenced, the mine is thought to have directly contributed only 370 persons to the town's population, which rose from 4,461 persons in 1968 to 5,326 persons in 1972.

Nevertheless, Cardinal River's directly and indirectly generated employment appears to have made a very substantial economic impact on the town.

Since 1968, the year before development of the mine site began, the value of new residential construction has risen from approximately $0.32 million to an average $1.2 million annually; and between 1969 and 1972, some $2.96 million were invested in construction of new commercial and industrial facilities. The year-by-year expenditures are shown in Table 9-1. From a breakdown of living accommodation used by Cardinal River employees (see Table 9-2), the Board concludes that the major portion of residential construction and a large part of commercial and industrial construction are directly attributable to the coal activity.

On the basis of a recent study by the Department of Municipal Affairs, which set the ratio of non-basic to basic industrial employment in Hinton at 0.63, the Board also estimates that coal mining has created indirect employment in Hinton for 120 persons.

TABLE 9-1

TOWN OF HINTON

Investment Activity - per Construction Permits

	1968	1969	1970	1971	1972
Residential	$ 321,350	$ 1,077,550	$ 981,350	$ 1,412,400	$ 1,457,900
Commercial	76,600	265,200	615,100	972,600	198,300
Industrial	700	-	-	137,000	773,000
Institutional and Other	24,000	107,200	145,100	115,650	42,150
Sub-Total	$ 422,650	$ 1,449,950	$ 1,741,550	$ 2,637,650	$ 2,471,350
Extraordinary items				Stud Mill	Underpass
				4,250,000	1,090,000
TOTAL	$ 422,650	$ 1,449,950	$ 1,741,550	$ 6,887,650	$ 3,561,350

TABLE 9-2

ESTIMATED BREAKDOWN OF LIVING ACCOMMODATION
CARDINAL RIVER EMPLOYEES

Single Family Houses	40 per cent
Apartments	26 per cent
Mobile Homes	24 per cent
Other	10 per cent

In the summer of 1973, Cardinal River announced the signing of a further 15-year contract under which 550,000 tons of coal annually will be shipped to Japan. This will effectively double the impact of coal mining on Hinton by mid-1974. The mine labour force is expected to rise to 400, and thus increase the town's population by some 750 persons. Indirect employment generated by the coal activity will increase to about 250. Assuming that the new mine employees will make much the same demands on living accommodation as present ones, an additional 80 houses, 60 apartments and 50 trailer facilities will be required.

The Board also expects that if adequate housing should become available in Hinton, Cardinal River employees who now reside at Cadomin and Robb will move into the town. It notes that permanent residence in these latter two communities is discouraged by, among other matters, the fact that neither has school facilities and school-age children have to be bused to Hinton. Company employees who live at Cadomin or Robb apparently do so mainly to avoid the daily 52-mile return journey from Hinton. However, since the company now regards its failure to provide a travel allowance as the major factor contributing to current high employment turnover (in excess of 100 per cent per year), it is likely to revise its policy on this matter.

Since the Cardinal River mine lies some 26 miles south-west of Hinton, it has no discernable environmental impact on the town. This would also apply to Cadomin and Robb. The mine site has been located on derelict lands left by earlier coal mining which, in fact, has led to substantial land improvement in the area. The first stage of construction of the new mine eliminated some of the scars of previous mining through building the processing plant on the old Luscar town site. All lands disturbed by mining are, or will be, revegetated. The company is currently experimenting with alternate restoration methods

and techniques for preparing seed beds. There is continuous monitoring of mine and plant effluents ultimately discharged into the main streams of the areas.

9.2.3 Canmore

Although Canmore, where Canmore Mines has conducted coal operations since 1886, is commonly identified as a mining community, the observable impact of coal development on it is relatively small. In part, this is due to the fact that coal production for the Japanese market is only marginally greater than output during the late 1950's and early 1960's. But also, as in mining communities in the Maritimes, many of the men affected by periodic layoffs at the mine have tended to stay in Canmore in expectation of being rehired when increased demand for coal called for additional labour. Overall population growth, therefore, has been modest. The community's economic gains from coal mining have been lessened because Canmore derives some benefits from other industrial activity in the region (e.g. the Exshaw cement plant) and from tourist traffic on the Calgary-Banff Highway.

In mid-1973, Canmore's work force consisted of 157 persons, of whom 72 live in the Town of Canmore and the rest in the adjacent Improvement District across the Bow River. The average annual income of the company's employees is about $9,800.

Assuming the same multiplier effect as is observed at Grande Cache and Hinton, indirect employment in the area created by the coal activity accommodates some 95 persons.

According to town officials, residential and commercial construction in Canmore since 1967 is valued at approximately $1.8 million; the general level of business has risen by some 60 per cent since then; and municipal revenues have increased by about 48 per cent over the same period. Table 9-3 summarizes some relevant annual statistics.

TABLE 9-3

TOWN OF CANMORE

Investment Activity - per Construction Permits

	1967	1968	1969	1970	1971	1972
Residential	$ 148,250	$ 63,425	$ 383,181	$ 251,725	$ 131,310	$ 263,193
Commercial	23,500	10,000	362,000	22,880	-	172,500
Industrial	-	-	-	-	-	-
Institutional and Other	-	-	-	-	-	-
TOTAL	$ 171,750	$ 73,425	$ 745,181	$ 274,605	$ 131,310	$ 435,693

Trade Volume (Thousands of Dollars)	1967	1968	1969	1970	1971	1972
Retail	1,536	1,625	1,886	2,261	2,376	2,500
Service	876	1,099	1,514	1,420	1,099	-
TOTAL	2,412	2,724	3,400	3,681	3,475	2,500

The mine site (mainly worked by underground operations) lies close to the town, and some of the community's older parts are significantly affected by dust from the processing plant and stockpiles. The newer residential areas, located on the opposite side of the Bow River, experience little adverse environmental impact from the mining operation. Canmore has successfully restored disturbances of earlier surface mining, and the stated policy of the company's new owners is to progressively upgrade all mined lands. No detrimental effluent from the mine is allowed to enter the Bow River.

9.2.4 Crowsnest Pass (Coleman)

A situation similar to that at Canmore exists in the Coleman-Blairmore area where coal mining has been carried on since 1911. At the peak of coal activity (in 1949), some 2.5 million tons of coal were produced from eight separate mines which employed more than 2,200 men; but successive closures during the 1950's reduced this number until only Coleman Collieries remained active. With that company's entry into the Japanese coal market, annual production rose from 633,000 tons in 1966 to 939,000 tons in 1972, and direct employment in mining increased over the same period from 450 to 490 persons.

Combined with considerable exploration activity by others in the region immediately north of Blairmore, this has had a pronounced rejuvenating effect on Coleman and communities as far east as Bellevue and Hillcrest.

A Board survey indicates that of the 292 underground miners at Coleman Collieries (see Table 9-4), some 60 per cent live in the Coleman district, 16 per cent at Blairmore, 14 per cent at Bellevue, and the remainder in the communities of Hillcrest, Burmis, Cowley and Frank. No information was obtained about the residences of the company's 200 other employees who are engaged in trucking, office and supervisory work, and a variety of related activities, nor about the distribution of the estimated

TABLE 9-4

EMPLOYMENT DISTRIBUTION COLEMAN COLLIERIES
JULY 1973

Underground (Hourly Paid)	292
General Office and Supervisory	76
Trucking	81
Other	41
TOTAL	490

300 persons in jobs indirectly created by current coal activity. However, statistical material supplied by local authorities (see Table 9-5) indicates that new construction in Coleman, Blairmore, Bellevue and Frank, between 1966 and 1972, totalled some $2.155 million, and that the trade volume between 1966 and 1971, the latest year for which complete data are available, rose by some 44 per cent from $6.16 to $8.84 million. Since the net population increase over this period (from 5,189 in 1966 to 5,375) appears to be mostly due to new miners and their families,[2] the Board believes that the greater part of these gains is directly attributable to coal development, although it recognizes some increases in other activity in the area.

A disturbing feature, which could well curtail further expansion, is a critical shortage of skilled underground miners and effective depletion of the available labour pool through large coal operations at Kaiser Resources' and Fording Coal's mine sites in British Columbia. The Board also notes the very high turnover at Coleman Collieries which has, in recent years, exceeded 100 per cent per year. This appears to be largely connected with the fact that some 40 per cent of Coleman Collieries' hourly paid mine workers are single and so more inclined to move from one job to another.

While current mining operations, located at higher elevations several miles from the town and out of sight of the highway, have no effect on Coleman, the stockpiling of raw and clean coal within the town creates an undesirable visual impact and also generates considerable airborne dust under certain weather conditions. Most directly and seriously affected is the area surrounding the plant. Progressive deterioration of this area has prompted relocation of residences and commercial enterprises

---

[2] On the assumption that each mine employee's household consists, on average, of 3.7 persons - as at the Cardinal River mine near Hinton - the additional 40 persons now employed by Coleman Collieries would account for 148 of 186 new residents.

TABLE 9-5

CROWSNEST PASS AREA

(COLEMAN, BLAIRMORE, BELLEVUE, FRANK)

Investment Activity - per Construction Permits

	1966	1967	1968	1969	1970	1971	1972*
Residential	$ 72,000	$ 92,000	$ 100,000	$ 117,000	$ 433,000	$ 470,000	$ 237,000
Commercial	31,000	30,000	5,000	23,000	24,000	155,000	166,000
Industrial	-	71,000	-	8,000	13,000	2,000	-
Institutional and Other	-	100,000	4,000	-	2,000	-	-
TOTAL	$ 103,000	$ 293,000	$ 109,000	$ 148,000	$ 472,000	$ 627,000	$ 403,000

	1966	1967	1968	1969	1970	1971	1972*
Trade Volume (Thousands of Dollars)							
Retail	5,166	5,408	5,962	6,461	7,277	7,245	N/A
Service	991	986	926	1,164	1,267	1,596	N/A
TOTAL	6,157	6,394	6,888	7,625	8,544	8,841	-

* Estimated.

at Coleman to an attractive residential and commercial complex at a higher elevation. Development here is severely restricted by a proposed new provincial highway. Recommendations by the town council and representatives of the mine owners that a route through the semi-derelict part of the old town be followed have so far met with negative response. Coleman Collieries has meanwhile accepted responsibility for cleaning up and restoring mine lands in the area abandoned by their previous owners.

9.3 Impact on Communities in the Plains Region

In the Plains, where four major strip operations and some 15 smaller mines, including two underground workings, produce thermal coal, the principal impact centres on communities in the vicinity of Lake Wabamun and in the Forestburg-Halkirk area.

9.3.1 Lake Wabamun

In the Lake Wabamun region, Manalta operates two large surface mines which in 1972 produced approximately 3.3 million tons of coal for Calgary Power's power plants. The combined labour force of the two mines total some 150 persons who earn an average of approximately $7,600 per year and reside for the most part in the Wabamun-Seba Beach-Fallis area.

Indirect employment attributable to coal activity in this area is about 45 persons.

Because the communities most immediately affected by the coal development are all unincorporated, no specific information about new construction and trade volumes could be obtained. But a review of employment statistics indicates that the great majority of mine employees are drawn from population within a 20 to 25 mile radius of the mine site, and that some 25 to 30 per cent live on farms and supplement their earnings by agricultural activity. Only 15 per cent of the work force live in mobile homes.

Experience duplicated elsewhere in the Plains Region has shown that employees from farming stock and living within commuting distance of the mine are particularly adaptable to surface mining operations, and that they are the main factor contributing to the stability of the work force. Turn-over rates are negligible, averaging about 3 per cent annually.

Although the coal activity disturbs a considerable acreage of marginal farmland, worked-out pit areas are being reclaimed as part of the on-going mining operation. To date about 75 per cent of some 800 acres of the total disturbed area at the Whitewood mine have been restored. In some cases the condition of the reclaimed land surpasses the original quality. Mining has not had any adverse environmental effect upon the communities surrounding the lake.

At the Highvale mine, reclamation has been limited, but will be intensified when mining has advanced beyond present stages. Other than its visual effect, this mine has had no adverse impact on neighbouring residents.

9.3.2 Forestburg-Halkirk

In the area between Forestburg and Halkirk, Forestburg Collieries and Manalta each operate a strip mine which supplies coal to Alberta Power's Battle River power plant. The combined labour force is 92 persons whose average income in 1972 was approximately $7,600.

Since both mines have operated for many years and, from the early 1960's on, grown in direct dependence on the power plant's coal demand, their impact on communities in the region is diffuse and primarily reflected in continuing expenditures on new construction (see Table 9-6). Trade volumes since 1964 have remained comparatively constant, possibly because purchases other than staples tend to be made in nearby larger centres.

The Board, however, did find a significant disparity between Forestburg Collieries' and Manalta's employees in the matter of

TABLE 9-6

TOWNS OF FORESTBURG AND HALKIRK

Investment Activity - per Construction Permits

	1964	1965	1966	1967	1968	1969	1970	1971	1972
Residential	$ 49,000	$ 42,000	$ 80,000	$ 109,000	$ 119,000	$ 154,000	$ 50,000	$ 20,000	$ 140,000
Commercial	-	-	86,000	11,000	13,000	48,000	-	3,000	136,000
Industrial	-	30,000	6,000	-	2,000	-	-	19,000	-
Institutional and Other	-	70,000	10,000	23,000	-	5,000	-	-	-
TOTAL	$ 49,000	$ 142,000	$ 182,000	$ 143,000	$ 134,000	$ 207,000	$ 50,000	$ 42,000	$ 276,000

	1964	1965	1966	1967	1968	1969	1970	1971	1972
Trade Volume (Thousands of Dollars)									
Retail	1,303	1,436	1,338	1,283	1,051	1,547	1,469	1,500	-
Service	373	708	708	885	888	668	64	143	-
TOTAL	1,676	2,144	2,046	2,168	1,939	2,215	1,533	1,643	-

their residences. While only 33 per cent of Forestburg Collieries' employees live on surrounding farms, fully 78 per cent of Manalta's work force does so. For all practical purposes, the Battle River appears to have become a distinct sociological barrier between the two communities.

Located some 10 miles from Forestburg and Halkirk, neither operation has environmental effects on these towns. The Vesta Mine on the south bank of the Battle River has experienced some difficulties in re-establishing vegetation on marginal farmland disturbed by it, apparently because of the bentonitic nature of the replaced overburden. Serious experimentation with landscaping and vegetation continues, and one terraced reclaimed area has shown good results over the last three summers. Otherwise, since there is no need for processing of the coal, the effect on the surrounding countryside is negligible. In all, some 200 acres of 950 acres disturbed to date have been reclaimed.

The Diplomat mine on the north side of the river works on richer farmland and does not encounter problems in revegetating mined out areas. So far, about 1,100 acres or 90 per cent of the disturbed surface has been reclaimed and some of this land has reverted to full agricultural use. However, old mining areas that have not been landscaped but which have naturally revegetated tend to mar the countryside because of the high mounds remaining from overburden dumping.

9.3.3 Other Plains Communities

Other coal mining in the Plains is presently on too small a scale to make a recognizable community impact - except, possibly, in East Coulee near Drumheller, where Century Coals operates an underground mine. Originally developing as a major coal mining centre, the city of Drumheller and the surrounding area are now mainly sustained by oil and gas activity and by

farming. Century Coals' activities have, therefore, little direct effect on the economic life of the area. Due to the limited (and still falling) demand for its output, production has been reduced to a current level of 50,000 tons per year. During the early winter of 1972-1973, the company employed some 55 persons in a two-shift operation, but this complement was reduced to 30 men in February 1973.

In anticipation of renewed mining in the future, many persons formerly associated with the coal industry continue to live in Drumheller.

Although Century Coals can legitimately claim that its current operations make no discernable environmental impact on the local community or on Drumheller some 12 miles away, the region bears the scars of earlier coal mining and abounds in abandoned mines. Improvements are not likely until resurgence of coal activity makes clean-up of these sites possible as an integral part of resumed mining.

9.4 Projected Developments

The Board anticipates that between now and 1983 several new developments will be proposed which would effectively double the current overall economic impact of coal development and affect communities in the Plains as well as in the Mountain and Foothills Regions.

An underground hydraulic mining complex near Rock Lake north of Hinton, now being considered by Denison, would entail an initial capital investment of $15 to $20 million, provide permanent employment for some 220 persons, and increase Hinton's population by about 800 residents (see Sec. 8.2.1). New residential and commercial construction in the town would require some $8.4 million; and assuming the same multiplier effect as at Hinton, some 140 additional persons should find employment in new or expanded business and service facilities required by the mine and its employees.

Proposed development by Manalta of an open pit mine with an ultimate production capability of 2 million tons per year in the Gregg River area would similarly mainly affect Hinton and its environs. Inclusive of a coal cleaning plant, the Board estimates that this project would require a capital investment of some $40 million, employ some 400 persons, and contribute some 1,400 residents to Hinton's population. To accommodate this influx, approximately $15 million would have to be spent on construction of new residential and commercial facilities. Indirect employment generated by the development in Hinton's business and service sector would require an additional 130 persons.

Another development, which the Board expects to be proposed shortly by Consolidation Coal Co. of Canada, is an open pit mine near Nordegg. Like Manalta's possible venture in the Gregg River area, the mine would be designed to produce 1.5-2 million tons of metallurgical coal per year for shimment to Japan. Initial capital investment would be in the order of $25 million, and a labour force of at least 220 men would be required. Mainly affecting Rocky Mountain House, this scheme is estimated to require about $7 million for new residential and commercial construction, and to afford some 110 permanent indirect employment opportunities in various supporting services.

Should demand for metallurgical coal warrant it, Granby Mining may later also propose development of an open pit mine on the Isolation Ridge property, some 30 miles north of Blairmore. Of the same type and size as the Manalta and Consol schemes, this operation would have much the same economic impact. But overall effects may be divided between Blairmore and a new mining town established closer to the mine site.

In the Plains Region, the Board anticipates development of two major surface mines before 1983, each virtually identical to the operations referred to in Section 9.3. These mines would be required in connection with new power plants, and, as

presently planned, would begin development in 1979 and 1982 and together, by 1983, would produce coal at a rate of 7 million tons per year.[3] The labour force needed for this output is expected to total about 350 men, with an average annual income of $15,000 in 1982. One of the two mines will be developed in the Riley-Dodds district, but there is still uncertainty about the location of the second. The most likely areas appear to be (a) the Sheerness area, and (b) the Ardley region immediately south of Alix, some 30 miles east of Red Deer. In all three areas, the impact would likely be as diffused over the respective counties as in the case of the Wabamun and Forestburg-Halkirk mines.

9.5 Typical Community Impact by the Annual Production of One Million Tons

From the observed impact of mining on neighbouring communities, the Board has developed three models which show the typical economic and social benefits accruing from annual production of one million tons of coal (see Table 9-7). While these figures are representative of new mines, the Board expects that projects with greater production rates will achieve some economies of scale and, therefore, caution must be exercised in extending these data to larger operations. For most mines anticipated in the Province the long-term annual production levels are likely to be substantially higher than 1 million tons. In the models considered here, production is assumed to come entirely from new surface mines. Underground mining would almost invariably require a significantly larger work force and so tend to increase the typical economic impact. All figures are quoted in terms of 1972 costs and make no allowance for escalation beyond that time.

---

[3] Should additions of Unit No. 5 to the Battle River and Sundance Power Plants precede the construction of a completely new power plant, this schedule would naturally be delayed.

TABLE 9-7

TYPICAL IMPACT OF ALTERNATE COAL MINING VENTURES - 1972

BASIS: PER MILLION SHORT TON PRODUCTION PER YEAR[1]

TYPE OF MINING	DEVELOPMENT/CONSTRUCTION INVESTMENT				MINE PRODUCTION COST[2]		EMPLOYMENT		
	Mine	Employment	Town	Employment	Labour	Materials	Basic	Non-Basic	Ratio
	10^6 $	Man-Yrs	10^6 $	Man-Yrs	($/ton)				
Surface Mining in a new town - Mts.	25	580	7.0	230	2.25	4.50	220	110	0.50
Surface Mining in an existing town - Mts.	25	580	8.0	260	2.25	4.50	220	145	0.65
Strip Mining in an existing town - Plains	10	320	3.0	100	0.60	0.70	80	25	0.30

[1] Figures should be considered as general with a possible variance of ± 10 per cent in the base year.

[2] Excluding fixed overhead, administration, royalty, processing.

9.5.1 New Town - Mountain Region

The Board estimates that where a new mine site is developed, as at Grande Cache, in a relatively remote and previously unsettled region therefore requiring a new town to house and serve mine employees and their families, the total population of the new community will be in the order of 1,300. Mine workers and their dependents would form approximately 70 per cent of this population.

Employment at the mine site in connection with production, processing and transportation of coal, would total about 250; and approximately 110 persons would find employment in service industries and other commercial establishments. In addition, some 20 jobs would be created to meet the health, educational and social needs of the town's population, and to provide administrative services.

Capital investment in the mine complex and annual operating expenditures would be in the order of $25 and $7 million respectively; approximately $7 million would be required for residential and commercial construction (including educational, medical and recreational facilities, as well as public services).

In current terms, the average annual income of mine employees is estimated by the Board at $11,000, but this is expected to escalate at rates in excess of 7 per cent per year for the forecast period.

9.5.2 Existing Town - Mountain Region

Where a new mining complex is located adjacent to, or within easy commuting distance of an existing community,[4] as at Hinton, the impact would be substantially similar.

The Board estimates that a mine producing 1 million tons annually would require a 220-man work force and result in a net addition of some 800 persons to an existing town. Residential

---

[4] On the basis of experience in Alberta and British Columbia, commuting distances up to about 25 miles appear to be acceptable.

and commercial construction needed to accommodate the influx would be marginally less than in the case of a new town, but indirect employment in the town's service and commercial sectors, including schools and medical facilities, would accommodate some 145 persons (see Section 9.1.5). Annual expenditures by the mining company on supplies and services would total some $6.75 million.

9.5.3 Plains Region Community

Except for a major near-surface coal deposit in the Fox Creek area, all large strippable coal deposits in the Plains occur near existing population centres, and a new mine would, therefore, not involve establishment of a new community. Since its output would be thermal coal, the mine would not require investments in coal processing and transportation facilities (other than short-haul trucks). Capital investment in the mining complex and the mine labour force would both be significantly smaller than in the Mountain Region.

The Board estimates that investment in a new Plains mine producing 1 million tons per year would total about $10 million, and that no more than 80 men would be required for the operation. However, this work force, for the most part, will be drawn from existing population in the area, and thus the mine would serve to stabilize the regional population and raise its economic level rather than attract new residents.

The current average annual income of mine employees in these areas is estimated at $8,000 and is expected to escalate at 6 per cent per year over the near future. The Board anticipates that the greater part of this income would be injected into the local economy through personal needs of mine employees and their dependents.

10 ENVIRONMENTAL ASPECTS

Like all other extractive or heavy industries, production of saleable coal is not without some adverse impact on the natural environment. However, as shown in the Board's report on the "Status of Environment Protection in the Alberta Energy Resource Industries" (ERCB 72-F, Chapter 12), which identified and discussed the environmental consequences of coal mining at some length, compliance with legislation passed since 1963 minimizes this impact and makes current coal operations more acceptable than is commonly supposed. Of particular importance in this regard (as noted in Section 4.4) are The Clean Air Act and The Clean Water Act, The Land Surface Conservation and Reclamation Act, and the general requirement that applicants seeking permits to undertake coal exploration or to develop a mine submit proposed land surface reclamation plans with their applications. These are reviewed and, where deemed necessary, are modified by the appropriate interdepartmental government committee.

10.1 Effects on Air Quality

Because of the low sulphur contents of Alberta coal, chemical pollution of the atmosphere can generally be discounted and, since the effects of noise created by mining operations are of little consequence, the principal concerns over air quality relate mainly to discharge of airborne dusts. Available evidence indicates that loading and hauling of coal from the mine to a processing facility or power plant create negligible dust problems, and that temporary difficulties, such as may be caused by high winds, can be overcome by water spraying. The same is true of coal stockpiles (which, as a rule, are only constructed when the normal delivery schedules are upset by interruption of unit-train operations) and of discard piles. However, substantial volumes of dust tend to be raised by thermal drying of coal at processing plants; and where this problem proves to be

unacceptable on social or environmental grounds, installation of dust precipitators may have to be required.

10.2 Effects on Water Quality

Precipitation and run-off from mines, coal stockpiles, and most discard piles in Alberta are mostly potable waters with a nearly neutral pH. The major exception is the muskeg water currently pumped from the Whitewood mine at a rate of some 0.5 million gallons per day.

A potentially more serious water pollution hazard, however, is posed by discard slurries emanating from coal processing plants and by accidental loading of natural water bodies with solids originating in improperly located or constructed coal or discard piles.

Discard slurries are now in all instances run into settling ponds from which clarified water is either recycled to the plant or returned to a natural water body. In the latter case, the Board and the Department of the Environment require regular monitoring of the pond effluent to ensure that no water leaves unless it meets the standards set by the Department of the Environment under The Clean Water Act.

Water pollution by solids from coal or discard piles is prevented by ensuring proper selection of sites for such piles before the mine site is developed.

The Board believes that the methods used to maintain the quality of natural water courses are adequate, but recognizes the need for continuing surveillance and prompt remedial action should accidental contamination of a water course occur.

10.3 Effects on the Land Surface

At the present level of coal activity in Alberta approximately 300 acres of land are annually disturbed by surface mining. However, since coal operators are now required to backfill mined-out surface pits and institute an approved land reclamation program as soon as the workings have sufficiently

advanced to make it practical, the total area remaining open in any 1 year is not significantly greater than new lands disturbed by the mining program.

Requirements for suitable reclamation of lands disturbed by coal exploration or mining upon completion or abandonment of the program were imposed in 1963 under The Surface Reclamation Act and enforced by the Surface Reclamation Council which also developed guidelines concerning the manner in which reclamation schemes were to be accomplished. With passage of The Land Surface Conservation and Reclamation Act, and closer control over reclamation by the Department of the Environment and the Department of Lands and Forests, the Board anticipates that these guidelines will be progressively amended to reflect more stringent social demands as well as the growing body of practical experience of mined-land reclamation in the Province. Permanent or long-term adverse effects of coal mining on the land surface should thereby be substantially eliminated.

There now appears to be general agreement that surface mining in the Plains region of the Province need not pose serious threats to the land surface, and high standards of reclamation can, in fact, generally be attained at relatively low costs. From completed reclamation of worked-out areas at operating mines immediately to the north of Lake Wabamun, the Board concludes that current reclamation costs in the Plains do not exceed $100 per acre, equivalent to less than 1 per cent of the cost per extracted ton of coal (presently valued at under $2.40 per ton).

Low to moderate costs are also indicated for reclamation in mountain terrain at elevations below tree line. Here, recently reported data indicate approximately 4 to 5 cents per extracted ton valued about $7.50, although this may be exceptional, and it might be more prudent to assume that typical costs may be nearer 10 to 15 cents per extracted ton.

Much more serious problems and substantially higher reclamation costs will undoubtedly be encountered at higher

elevations, where native topsoil, if present at all, is generally thin and climatic conditions, as well as difficulties in creating an appropriate seed bed, may at times severely limit the type of reclamation that can be accomplished. However, even at sites above tree line, acceptable reclamation appears to be technically possible at costs not exceeding 30 to 35 cents per extracted ton if reclamation requirements are developed with due regard to the nature of the pre-existing terrain and clearly stipulated before mining companies begin field operations. The Board views this as of paramount importance for successful reclamation at acceptable costs. There is some evidence that unsatisfactory reclamation is frequently due to operators being unsure of what is expected of them.

More generally, the Board believes that the practical experience of reclamation now being accumulated in Alberta will prove an invaluable guide to future reclamation programs. It notes, in this connection, the substantial efforts which coal companies currently make to determine the plant species most appropriate for revegetation programs in mountain areas.

11 IMPACT ON THE ECONOMY OF ALBERTA

The benefits which Alberta, and indirectly other regions of Canada, derive from development of the Province's coal resources, lie ultimately in

(a) the mining companies' demands for goods and services (which are broadly reflected in the companies' total capital outlays and operating expenditures),

(b) the multiplicity of employment opportunities created thereby, and

(c) public revenues generated by coal-related activities.

Through development of thermal coal resources in the Plains region, a further major benefit accrues, however, from the possibility of substituting coal for natural gas in the generation of electric energy. In the Board's view, this will eventually far outweigh other gains, especially gains through increased public revenues. By fuelling new thermal power plants with coal, approximately 11.5 Tcf of gas could be diverted to other, mainly extraprovincial, markets in the period to 2001 A.D., with corresponding large cash flows into Alberta.

11.1 Expenditures on Goods and Services

The Board estimates that since 1963, some $160 million have been invested in new facilities for mining, processing and transporting Alberta coal. Approximately 55 per cent of this total, or about $85 million have been expended on goods and services in the Province.

Annual operating expenditures, up to 80 per cent of which are for goods and services in Alberta, have risen from about $8 million in 1963 to $41 million in 1972, and aggregate in some $170 million over the 10-year period. In addition some $3 million annually have been spent on coal exploration.

Projected new coal developments to 1982 are expected to result in direct capital outlays at the mines of about $800 million, and for transportation systems of $310 million, of

which roughly 55 per cent will relate to goods and services supplied in Alberta; and annual operating expenditures are anticipated to rise to about $315 million in 1982.[1] Cumulative operating expenditures over the period 1973-82 are estimated to total some $1,600 million, of which 80 per cent are likely to be retained within the Province. The Board also estimates that future exploration expenditures will be 4 to 5 million dollars annually all of which is expected to be spent in Alberta. Direct investment in the towns to meet the requirements of employees associated with coal mining is forecast to require some $260 million over the forecast period.

11.2 Employment

11.2.1 Direct Employment

From information furnished by Alberta coal companies, the Board has concluded that direct permanent employment in connection with coal exploration, mining and processing stands currently at some 1,900 persons, mainly skilled labour and commanding an average annual income of $10,000. Table 11-1 shows the manner in which this income tends to be disposed.

Having regard to new coal developments between now and 1982 (see Section 7), the Board expects direct employment to increase to about 9,300 persons by 1982. In addition, some 29,500 man-years are estimated to be required for construction of the projected new facilities, and coal transportation will result in employment for an additional 2,500 people.

11.2.2 Indirect Employment

A survey of communities near which coal mining operations are currently being conducted (see Section 9) has led the Board to conclude that the ratio of direct to indirect employment in adjoining communities is approximately 1:0.65. Total indirect

---

[1] Assuming a 4 per cent annual increase in production cost over the forecast period.

employment in enterprises serving the mines and the personal needs of mine workers and their families is, therefore, some 1,050 persons. This total, which does not include employment in construction, is expected to rise to about 5,400 persons by 1982.

11.2.3 Induced Employment

Recent Government of Canada studies indicate that each new direct employment opportunity in coal mining in Canada generates, on average, 4.5 jobs in manufacturing, supply services, transportation, administration and the like. Using this multiplier, the Board estimates that total induced permanent employment attributable to coal development in Alberta (inclusive of the indirect employment noted in Section 11-22) now stands at about 8,550 persons. This would increase to approximately 42,000 persons by 1982.

11.3 Alberta Government Revenues and Expenditures Related to the Alberta Coal Industry

Table 11-2 shows the Alberta Government revenues for a few selected years from lease fees, lease rentals, royalties and bonuses. These have grown from less than $200,000 in 1963 to nearly $2.5 million in 1972. They are still small compared with the value of the coal production -- some $49 million in 1972. The table also shows the Alberta corporate and personal income tax attributable to the coal industry.

Alberta Government expenditures on research and development related to the coal industry have grown from $139,000 in 1963 to $281,000 in 1972. These funds have been provided for work done by the Research Council of Alberta.

Direct revenues to the Alberta Government will increase in proportion to activity and production in the industry and further to the extent that rental rates and royalties may be increased.

TABLE

INCOME DISPOSITION -

	1963	1964	1965	1966	1967
Total Number of Employees	1,131	1,188	1,181	1,146	1,162
Average Income	4,095	4,382	4,834	5,147	5,418
Total Income	4,609,735	5,205,816	5,708,954	5,898,462	6,295,716
Disposition of Income *					
Federal Taxes Paid	298,436	354,308	405,907	416,903	462,357
Provincial Taxes Paid	61,125	77,775	107,899	131,654	179,806
Total Taxes	359,561	432,083	513,806	548,557	642,163
Food	825,146	931,841	1,010,485	1,044,028	1,101,750
Shelter and Household Operations	1,175,488	1,317,072	1,432,947	1,474,616	1,561,338
Clothing	495,658	453,906	490,970	507,268	535,136
Personal and Health Care	248,927	281,114	308,284	312,618	333,673
Smoking and Alcoholic Beverages	147,515	166,586	182,687	188,751	195,167
Travel and Transportation	705,293	791,284	862,052	884,769	938,062
Recreation	198,319	218,644	239,776	247,735	264,420
Miscellaneous	175,171	197,821	216,940	224,142	232,941
Security and Gifts	368,780	416,465	451,007	465,978	491,066
Total	4,259,194	4,773,733	5,193,148	5,349,905	5,653,553

* Expenditure disposition assumed to be on the same basis for all years as 1969 Survey by Statistics Canada.

** Estimated

11-1

ALBERTA MINING INDUSTRY

1968	1969	1970	1971	1972**		10 Year Totals $
1,103	1,209	1,654	2,068	1,898		
5,848	6,941	8,088	8,454	10,010		
6,450,344	8,391,669	13,377,552	17,482,872	19,000,000		
534,089	863,167	1,541,629	2,014,726	2,462,000	+	9,353,522
207,701	378,800	759,310	992,328	958,000	+	3,854,398
741,790	1,241,967	2,300,939	3,007,054	3,420,000		13,207,920
1,109,459	1,393,017	2,153,786	2,814,742	3,059,000		15,443,254
1,573,883	1,972,042	3,050,082	3,986,095	4,294,000		21,837,563
541,829	679,725	1,056,826	1,381,147	1,463,000		7,514,465
335,418	419,584	655,500	856,661	912,000		4,663,779
199,961	251,750	387,949	507,003	532,000		2,759,366
948,201	1,183,225	1,832,725	2,395,153	2,584,000		13,124,764
264,464	327,275	508,347	664,349	722,000		3,655,229
238,663	302,100	468,214	611,901	646,000		3,313,893
496,676	620,984	963,184	1,258,767	1,368,000		6,900,907
5,708,554	7,149,702	11,076,613	14,475,818	15,580,000		79,213,220

TABLE 11-2

ALBERTA GOVERNMENT REVENUES AND EXPENDITURES RELATED TO THE ALBERTA COAL INDUSTRY

	1963	1966	1969	1972	Cumulative Total 1963-1972
Alberta Government Revenues ($)					
Lease Fees	270	215	715	4,690	19,945
Rentals	81,818	80,116	417,203	1,784,106	5,758,940
Royalties	111,896	192,346	138,914	621,950	2,734,365
Bonuses	---	---	139,603	---	139,686
Sundries	2,128	2,221	2,211	25	20,964
Sub-Total	196,112	274,898	698,646	2,410,771	8,673,900
Corporate Income Tax[1]	n/a	21,000	11,000	n/a[2]	
Personal Income Tax[1]	61,000	132,000	378,000	958,000	
Alberta Government Expenditure on Research and Development ($)	139,000	174,000	228,000	281,000	2,063,000

[1] Estimated.

[2] Not Available.

12 OBSERVATIONS AND RECOMMENDATIONS

Current and projected demands for coal make it evident that Alberta's coal resources have regained major economic importance. In terms of capital investment, employment, and value of annual production, the coal industry already ranks as the Province's third largest extractive industry, and all indications point to it rapidly expanding its role in domestic as well as foreign markets.

The coal industry now in being is far different from the historical industry which existed until the early 1950's. Of particular significance is the replacement of the multiplicity of small and generally short-lived workings by a handful of large mine sites, and the concentration of mining activity in the hands of producers who, because of their greater financial and technical resources, are better able than their predecessors to conduct high-volume long-term operations. This transformation has contributed much to creating a more favourable competitive position for coal vis-a-vis alternative fuels, and endowed the industry with an inherent stability which it lacked throughout the historical period. The Board believes that this will help the industry gain growing acceptance as a reliable supplier of fuel in foreign as well as in extraprovincial domestic markets.

The Board also observes that concentration of mining activity has served to reduce the overall environmental impact of the industry on the Province, and that the massive investments needed to bring large mine sites into production offer in themselves some guarantee that mining operations will be conducted in a socially acceptable manner.

The market outlook for the industry is excellent. The market for thermal coal in Alberta is expected to nearly triple by 1982 and by then also extraprovincial markets are expected to develop for some 10 million tons per year from the Foothills.

The market for metallurgical coal in Japan is expected to continue to expand and new markets may be anticipated in Ontario, Europe and South America. The Board believes that the present dependence on Japan as a single market will be very substantially reduced over the next few years, thereby reducing the metallurgical coal sector's vulnerability to influence from factors over which the producers have no control. Total production of metallurgical coal will likely increase more than fourfold by 1982.

Notwithstanding this generally favourable view of the industry, concern must be expressed over weaknesses in the metallurgical sector of the coal industry. The Board is aware that at least two of the four mining operations now being carried on in the Mountain Region are still beset by economic problems. These originated in earlier under-estimates of production problems and costs. The Board recognizes that these misjudgments were made during the pioneering phase of the revitalized coal industry when some coal owners were perhaps over-anxious to gain a share of the emerging Japanese market. It believes that the rapidly rising demand for coal, which is already beginning to create a seller's market, is likely to prevent similar errors being made in the future. The Board also accepts that recent contract renegotiations, which have led to substantial price adjustments, will alleviate problems at the mines in question. However, assured long-term economic viability and fair return to Alberta for removal of a non-renewable resource demands better marketing practices than the industry has so far used. The Board observes, in this connection, that some 75 per cent of all metallurgical coal presently produced in the Province is derived from mines that will not be profitable in the accepted sense of the term for several years.

The Board considers that benefits to the Province through capital investments, annual operating expenditures, and generation

of new employment opportunities are themselves ample warrant for encouraging further development of the coal industry.

It notes that the royalty of $0.10 per ton on thermal coal having an average value of about $2.00 per ton represents a royalty of only 5 per cent. This low rate has been justified historically because of the marginal economics throughout the coal industry. It cannot be justified on those grounds today in the thermal coal industry, however, so long as the thermal coal is produced for generation of electric energy for use in Alberta, a low royalty may be justified on the grounds that the production is for the direct benefit of the people of Alberta. Accordingly, the Board sees no need at this time to revise the royalty rate as it now applies to thermal coal produced for use in Alberta. The royalty rate should be reviewed prior to the time that thermal coal, or energy derived from it, begins to be moved to extraprovincial markets.

Turning to metallurgical coal, all of which is presently shipped out of Alberta, the Board notes that the royalty of $0.10 per ton is at a rate of less than 1 per cent on the average value in 1972 of about $11.00 per ton. Again the low rate has some historical justification and even today one may argue for its continuance on the grounds that the metallurgical coal industry is not enjoying normal profits. On the other hand, the royalty rate is not compatible with any reasonable interpretation of the Government's share of ownership nor with the fact that the coal is all exported. Having regard for the improving market outlook, the Board believes that consideration should be given to gradually increasing the royalty on metallurgical coal, perhaps over a period of 5 years, to a level more appropriate to the value of the coal and the fact that it is marketed outside Alberta.

Finally, the Board considers that supply of qualified mine labour poses a serious problem for further development,

particularly as the types of labour required for surface mining will also be in increasing demand by new oil sands operations. The Board believes that anticipated severe labour shortages can only be resolved by some form of Government assistance, and that the role of Government will in some circumstances have to extend beyond manpower training programs. In particular, close collaboration will be necessary between the industry, departments of Government and municipalities directly affected by mining development in order to provide suitable accommodation for mine employees and their families.

Having regard to these and other matters dealt with in this report, the Board believes the following to be among actions that would facilitate further orderly development of Alberta's coal resources in the public interest:

1. Early and clear definition of policies respecting land use in those parts of the Foothills and Mountain Regions in which massive, economically recoverable reserves of coal are known or believed to occur (see Sec. 6.2.3). This is probably a matter for consideration by the Cabinet Committee on Resource Development.
2. Development and publication of practical guidelines on land reclamation in those areas in which coal development is anticipated over the next few years, and the subsequent advice to developers of reclamation requirements before development commences (see Sec. 4.4 and 10.3). Presumably these guidelines will be developed by the Department of the Environment and the Department of Lands and Forests, and where reclamation procedures may bear on coal conservation, by the Board.
3. Determination of anticipated manpower needs in various categories of skilled labour, and consideration of the establishment of training programs to satisfy these

requirements (see Sec. 6.2.2). This could appropriately be undertaken by the Department of Manpower and Labour in conjunction with the industry.

4. Determination of what community planning projects need now be undertaken in order to accommodate the expected influx of new mine employees and their families (see Sec. 6.2.2). The Board believes that this might best be carried out by the Department of Municipal Affairs, the directly affected municipalities, and The Coal Association of Canada.
5. Determination of the practical assistance which the Government of Alberta should give to ensure development of improved coal mining technology in Foothills and Mountain terrain (see Sec. 6.2.1). In the Board's view, this might be accomplished through consultations between the Department of Mines and Minerals, The Coal Association of Canada and the Board.
6. Development of more effective marketing by the Alberta coal industry and, in particular, an examination of the advisability of establishing a coal marketing agency under industry auspices to be responsible for coal export from Canada (see Sec. 8.5). The Board believes that this is a matter to which The Coal Association of Canada should direct immediate attention, and concerning which the Department of Industry and Commerce could provide valuable assistance.
7. A review of the royalty rate on thermal coal in advance of any extraprovincial marketing of such coal.
8. An early review of the royalty rate on metallurgical coal and establishment of a schedule for its gradual increase.

From an overview of this study the Board also considers it necessary that closer attention be given to economic aspects of

new coal developments. The Board recognizes that, in particular cases, major coal developments in the future may involve substantial Provincial commitments and expenditures by various levels of government and by private individuals, and that it would be in the public interest for the Government to have a reasonable assurance of the permanence and soundness of these investments. The Board believes that in such cases, it may be appropriate for the Lieutenant Governor in Council, under the provision of Section 24(1) of The Energy Resources Conservation Act, to request the Board to investigate the general economic feasibility of the proposed project and to advise the Government thereon.

Respectfully submitted,

G. W. Govier, P. Eng.
Chairman

D. R. Craig, P. Eng.
Vice Chairman

N. Berkowitz
Board Member

DATED at Calgary, Alberta

this 29th day of March, A.D. 1974.

APPENDIX A

Approved and Ordered,

LIEUTENANT GOVERNOR

O.C. 289/73

Edmonton
February 22, 1973.

WHEREAS it is expedient and in the public interest to request the Energy Resources Conservation Board to inquire into and report on the whole matter of the current and future impact of the Alberta coal industry on the economy of the Province:

THEREFORE, upon the recommendation of the Honourable the Minister of Mines and Minerals, the Lieutenant Governor in Council, pursuant to section 24, subsection (1) of The Energy Resources Conservation Act, requests the ENERGY RESOURCES CONSERVATION BOARD to inquire into and make a report on the current and future impact of the Alberta coal industry on the economy of the Province, and to advise him on

(a) direct and indirect capital investment in coal mines, coal processing plants, rail and terminal facilities, and related installations;
(b) direct and indirect employment, and income effects therefrom;
(c) the impact of expenditures by the coal industry on communities in or near which mining or coal processing operations are being conducted;
(d) an assessment of the proportions of capital investment and cash flow generated by the coal industry which remain in Alberta;

(e) revenues accruing to the Government of Alberta from coal royalties, from the provincial share of corporate income taxes, and from other sources related to the coal industry;

(f) the outlook for coal production in Alberta, with special reference to

(i) coal requirements within Alberta,

(ii) Canadian demand for Alberta coal,

(iii) Japanese demands for Alberta coal, and

(iv) other markets;

(g) technical developments which could affect the demand for or the price of Alberta coal and in particular

(i) coal gasification,

(ii) pipeline transporation of coal as slurry or in other forms,

(iii) improved rail haulage, and

(iv) coal versus gas fired thermal electric generating plants.

CHAIRMAN

APPENDIX B

THE PROVINCE OF ALBERTA

ENERGY RESOURCES CONSERVATION BOARD

Informational Letter
No. IL-C 73-3

TO: Companies, Labour Organizations, Municipalities and Research Agencies with Direct Interests in Coal Exploration, Production, Processing, Transportation, Marketing and Use

Coal Industry Study

By Order in Council, numbered O.C. 289/73 and dated February 22, 1973, the Board has been requested to inquire into and make a report and advise respecting the current and probable future impact of the Alberta coal industry on the general economy of the Province. The particular matters to be considered, as set out in the Order in Council, have been published in the Board's Notice of Hearing, a copy of which is appended.

To facilitate the study the Board requests the assistance of coal companies and others having a direct interest in coal exploration, production, processing, transportation and marketing, or in any special aspect thereof, and also invites responses from labour organizations with interests in the Alberta coal industry, from municipalities directly affected by coal industry operations, and from research agencies and educational institutions with active interests in any of the matters falling within the broad scope of the inquiry.

In conducting the study, the Board intends to direct special attention to the following topics:

1. current and projected markets for the different types of Alberta coal in (a) Alberta, (b) other parts of Canada, (c) Japan, and (d) elsewhere, average prices presently commanded by Alberta coal in the various markets, and anticipated pricing trends;

2. technical developments and trends in energy demand/supply patterns that could affect markets and prices, with special reference to

   (a) new mining technology,

(b) improved or novel transportation systems (including solids pipe lines),

(c) fuel conversion technology (including coal gasification),

(d) effects of costs of alternative fuels or methods for producing useful energy.

3. corporate ownership and financial structure of companies involved in exploration, mining, processing, transportation and marketing;

4. historical and projected coal exploration activities over the period 1963 to 1983, with particular reference to

(a) capital investments in facilities and equipment,

(b) annual operating expenditures,

(c) direct and indirect employment (including sources of manpower, manpower turnover, generalized payroll data and, where appropriate, manpower training programs and facilities), and

(d) goods, supplies and services purchased in Alberta;

5. historical and projected mining activities over the period 1963 to 1983, with particular reference to

(a) capital investments in facilities, equipment, and ancillary services,

(b) annual operating expenditures,

(c) direct and indirect employment (as under item 4(c)), and

(d) goods, supplies and services purchased in Alberta;

6. historical and projected coal processing activities over the period 1963 to 1983, with particular reference to

(a) capital investments in facilities, equipment and ancillary services,

(b) annual operating expenditures,

(c) direct and indirect employment (as under item 4(c)), and

(d) goods, supplies and services purchased in Alberta;

7. historical and projected coal transportation activities over the period 1963 to 1983, with particular reference to

(a) capital investments in facilities, equipment and ancillary services,

(b) annual operating expenditures,

(c) direct and indirect employment (as under item 4(c)), and

(d) goods, supplies and services purchased in Alberta;

8. historical and projected support services and indirect business impact of items 4, 5, 6 and 7 above, with particular reference to

(a) types of support service or indirect business impact,

(b) capital investments in facilities and equipment directly required for servicing coal industry operations,

(c) annual operating expenditures, and

(d) employment (as under item 4(c));

9. the historical and projected impact over the period 1963 to 1983 of coal industry and related operations referred to in items 4 to 8 above on nearby communities, including

(a) general social and economic effects of coal operations on communities in or near which they are being conducted, and

(b) municipal revenues and expenditures directly or indirectly attributable to nearby coal operations.

10. the historical and projected impact over the period 1963 to 1983 of coal industry and related operations referred to in items 4 to 8 above on the Province of Alberta.

In all cases in which projections are made, the assumptions underlying the projections should be clearly stated, and general statements based on confidential data which participants do not wish to disclose in detail should be identified as such.

The Board would welcome information on any of the topics enumerated above, or on any clearly defined aspect thereof, and asks that twelve copies of each brief be submitted to it. In accordance with the Notice of Hearing, written briefs are to be filed with the Board at its offices at 603 - 6 Avenue S. W., Calgary, on or before Monday, June 4, 1973.

As indicated in the Notice, the Board will hear representations respecting submissions at a public hearing commencing at 9:00 a.m. on Tuesday, June 19, 1973 in Room 201 of the Court House, Calgary. The Board asks that those submitting briefs attend and participate in the hearing, but advises that the filing of a submission does not make attendance or participation obligatory.

The Board's staff would be pleased to assist any person seeking further information respecting the briefs or related procedures or matters. Inquiries should be directed to Mr. W. A. Fowers, Manager, Coal Department, at the Board's Calgary office.

ISSUED at Calgary, Alberta on April 24, 1973.

ENERGY RESOURCES CONSERVATION BOARD

N. Berkowitz
Board Member

Attachment

ENERGY RESOURCES CONSERVATION BOARD

Proceeding No. 7027

NOTICE OF HEARING

TAKE NOTICE that the Energy Resources Conservation Board, having been requested by the Lieutenant Governor in Council to inquire into and make a report on the current and future impact of the Alberta coal industry on the economy of the Province, and to advise him on the matters listed below, will hold a public hearing in Room 201, Court House, Calgary, Alberta, on Tuesday, June 19, 1973, at the hour of 9:00 a.m. for the purpose of hearing representations respecting matters within the purview of the appraisal.

In accordance with the provisions of Order in Council numbered O.C. 289/73 and dated February 22, 1973, the Board will consider

(a) direct and indirect capital investment in coal mines, coal processing plants, rail and terminal facilities, and related installations;

(b) direct and indirect employment, and income effects therefrom;

(c) the impact of expenditures by the coal industry on communities in or near which mining or coal processing operations are being conducted;

(d) an assessment of the proportions of capital investment and cash flow generated by the coal industry which remain in Alberta;

(e) revenues accruing to the Government of Alberta from coal royalties, from the provincial share of corporate income taxes, and from other sources related to the coal industry;

(f) the outlook for coal production in Alberta, with special reference to

(i) coal requirements within Alberta,

(ii) Canadian demand for Alberta coal,

(iii) Japanese demands for Alberta coal, and

(iv) other markets;

(g) technical developments which could affect the demand for or the price of Alberta coal and in particular

(i) coal gasification,

(ii) pipeline transportation of coal as slurry or in other forms,

(iii) improved rail haulage, and

(iv) coal versus gas fired thermal electric generating plants.

Further details concerning these and related matters to which the Board intends to direct attention will be provided in an Informational Letter to be issued before April 23, 1973.

The Board requests submissions covering all or any clearly defined part of the topics enumerated above. Any person intending to make such a submission shall file on or before June 4, 1973 twelve copies of the submission with the Board at 603 - 6 Avenue S. W., Calgary, Alberta. A copy of each submission will be available for inspection at the offices of the Board after June 6, 1973.

Any person intending to make a submission in response to one filed in accordance with the last preceding paragraph shall file on or before June 15, 1973 twelve copies of his submission with the Board and one copy with the person with respect to whose submission he is responding at the address set out in that person's submission.

DATED at Calgary, Alberta, on April 12, 1973.

N. A. MacLeod
Board Solicitor

APPENDIX C

HOUSING POLICY FOR McINTYRE EMPLOYEES

McIntyre's housing policy is designed to encourage our employees to purchase their homes. We felt that this was good for the employee, good for the Company, and good for the Community.

For this reason, McIntyre has established the following policy:

1. Houses will be sold at construction cost, without down-payment.
2. Mortgages will be arranged and guaranteed by McIntyre.
3. The first mortgage, at current interest rates, will be for approximately 80 percent of the selling price. These mortgages are repayable over a twenty-five year period and are CMHC approved.
4. The balance of the purchase price on each home will be paid by Smoky River Investments Ltd. The homeowner will enter into an "Acceptance of liability" Agreement for this amount with Smoky River Investments Ltd. This is in effect a loan to the employee, on which he will make no payments. For employees prior to January 1st, 1972 no interest will be charged. After the first five years of the contract, Smoky River Investments Ltd. will reduce the amount of the 'loan' by one-tenth per year. This loan reduction will be applied to building up personal equity for the employee in his home. The total liability will be for-given at the end of the fifteenth year.
   For employees after January 1st, 1972 the balance of the purchase price is defered at no interest to the 15th year at which time the employee is responsible for repayment in total to McIntyre.

5. Under the conditions of the sale, during the first fifteen years of the contract, Smoky River Investments Ltd. must buy back the property from the employee. During this time, if the employee leaves, he must sell his property to Smoky River Investments Ltd. This condition safe-guards the employee in case of termination of employment, death, default of purchase agreement or when he ceases to be in continuous possession of the home. If a home is bought back by the Company during the first five years, the price of the buy-back will be the initial cost plus the value of the improvements up to a maximum of $2,000.00.

   If the buy-back occurs within the second five-year period, then the general housing market conditions in Grande Cache will also be taken into account, to the employee's benefit. During the third five-year period of the agreement, Smoky River Investments Ltd. will have the first right of refusal to purchase the home from the employee at a price which any bona fide purchaser would pay.

   After the fifteenth year of the agreement, Smoky River Investments Ltd. will have no rights or obligations insofar as buy-backs are concerned.

6. To assist the employee pay off the first mortgage, McIntyre will pay employees, who are purchasing a home, a monthly subsidy of $100.00.

8. Relocation costs were modified in early 1972 and are now considered on an individual basis.

9. This policy means that an employee can purchase a home costing between $18,500.00 and $28,000.00 without a down-payment. If we assume that the employee receives a net $75.00 after tax benefit

from his monthly subsidy of $100.00, the monthly cost of purchasing a home, including property taxes, will range between $90.00 and $180.00 per month.